

An annotated avian checklist of Bornadi Wildlife Sanctuary, Assam, India

Vivek Chetry¹, Prasanta Kumar Saikia¹, Pranjal Mahananda¹, Malabika Kakati Saikia¹, Kuladip Sarma¹

¹ Animal Ecology and Wildlife Biology Laboratory, Department of Zoology, Gauhati University, Guwahati, Assam, India

Corresponding author: Prasanta Kumar Saikia (saikiapk@rediffmail.com)

Abstract. The Bornadi Wildlife Sanctuary (BWS) boasts a variety of habitats, including forest, riparian, degraded forest, and transitional zones located near human settlements and cropland. From 2019 to 2022, a thorough avian survey was conducted using the point count method, covering all habitats and seasons. The study documented 227 avian species from 65 families and 18 orders. Of the bird species observed, 72.3% were resident, and 27.7% were migratory. Over the study period, one Endangered species, three Vulnerable, and six Near Threatened species were recorded based on their IUCN Red List status. The avian diversity pattern in BWS is influenced by a variety of factors, including forest contiguity and heterogeneous habitat. Proper evaluation and management of habitats are essential for the recovery and preservation of fragile environments susceptible to decline in the region.

Key words. Avifauna, diversity, eastern Himalaya, heterogeneous habitats, IUCN Red List

Chetry V, Saikia PK, Mahananda P, Saikia MK, Sarma K (2024) An annotated avian checklist of Bornadi Wildlife Sanctuary, Assam, India. *Check List* 20 (3): 665-691. <https://doi.org/10.15560/20.3.665>

INTRODUCTION

Birds play a vital role in our ecosystem, with their presence, absence, or behaviour offering valuable insights into the health and biodiversity of an area. Bird surveys have become a standard tool for assessing the health of ecosystems, especially in areas where data is scarce or limited (Bibby et al. 2000). By monitoring bird populations, scientists and conservationists can glean valuable information on climate change impacts, land use practices, and habitat degradation (Gregory and Strien 2010). In less-known areas, birds can be crucial in identifying regions with biodiversity and conservation value (Martínez-Núñez et al. 2023). For example, in the Eastern Himalayas, where there is a high level of bird endemism, bird surveys have been used to pinpoint areas that require conservation attention (BirdLife International 2023).

The state of Assam in Northeast India is a biodiversity-rich region where two global biodiversity hotspots meet, namely, the Himalayan and the Indo-Burma regions (Myers et al. 2000). These areas have high species richness and contain endemic, migratory, and threatened species of various flora and fauna, including birds (Jenkins et al. 2013). Some 820 bird species are known to occur in Assam (Choudhury 2000), however, avian diversity studies have been limited to a few protected areas (Saikia and Saikia 2000; Barua and Sharma 2005; Choudhury 2006; Devi and Saikia 2010; Saikia and Devi 2011; Mahanta et al. 2019; Mahanta et al. 2022; Kakati et al. 2022).

The Bornadi Wildlife Sanctuary (BWS), an Important Bird and Biodiversity Area (IBA), is situated in Assam's Udalguri district. This area received IBA status due to the presence of the critically endangered Bengal Florican *Houbaropsis bengalensis* (Gmelin, 1789) (BirdLife International 2023). Despite being a vital habitat for avian species, the avian diversity of BWS is not well documented, with only a few species reports available (Chakraborty et al. 2015). The primary objective of this study is to document the diversity and better understand the avian community within BWS.

STUDY AREA

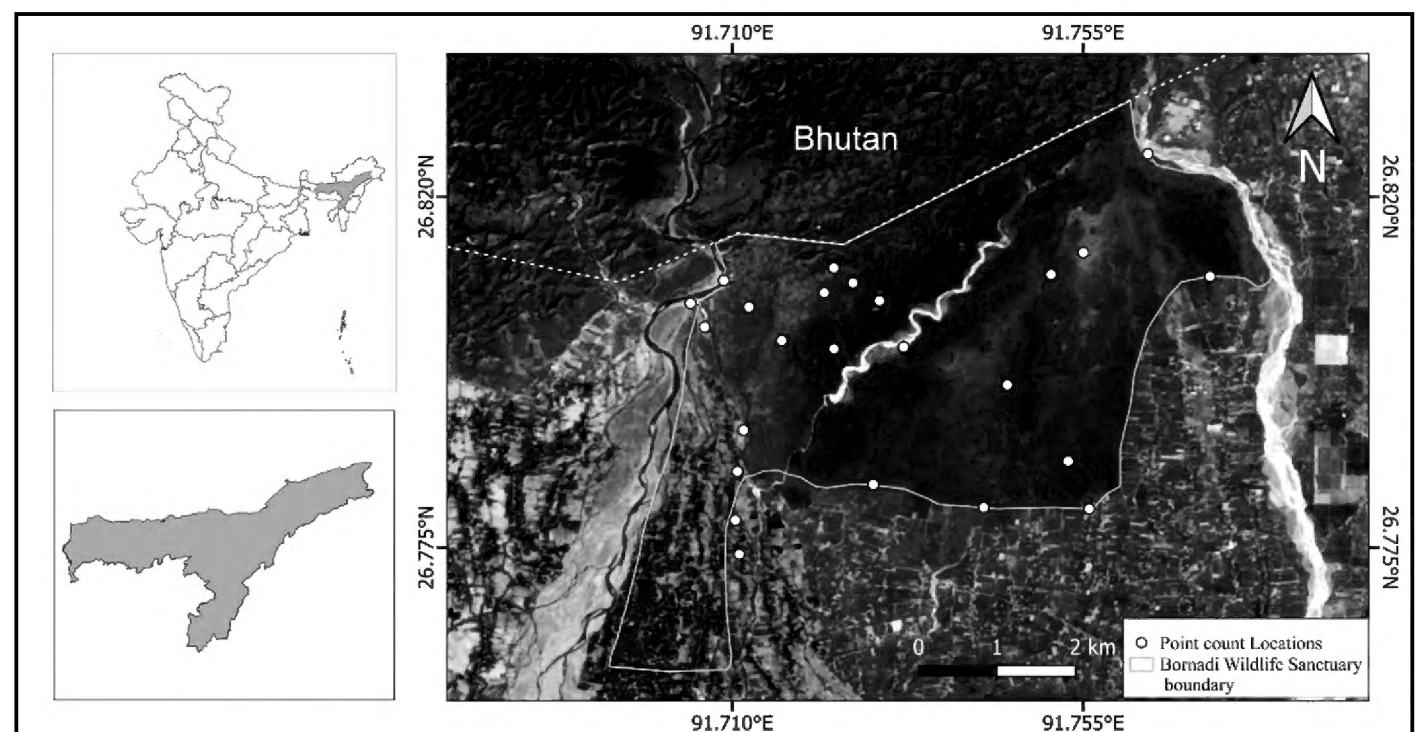
Covering an area of 26.22 km², Bornadi Wildlife Sanctuary is situated in the Bhabar zone of the eastern Himalayan foothill region in Assam (Figure 1). The Nalapara River runs along the eastern border of the sanctuary, while the Bornadi River marks its western boundary. BWS shares its northern border with the Jomotsangkha Wildlife Sanctuary in Bhutan, creating a transboundary forest complex. Settlements and



Academic editor: Govindan Veeraswami Gopi
Received: 15 February 2024
Accepted: 22 May 2024
Published: 10 June 2024

Copyright © The authors. This is an open-access article distributed under terms of the Creative Commons Attribution License (Attribution 4.0 International – CC BY 4.0)

Figure 1. Location of sampling stations in Bornadi Wildlife Sanctuary, Assam, India.



plantations, mainly tea gardens, are located along the southern boundary. BWS was declared a wildlife sanctuary in 1980 due to the presence of the endangered Pygmy Hog (*Porcula salvania* Hodgson, 1847) and Hispid Hare (*Caprolagus hispidus* Pearson, 1839). BWS is also home to several important Indian species, including *Panthera tigris tigris* (Linnaeus, 1758), *Panthera pardus fusca* (Meyer, 1794), *Neofelis nebulosa* (Griffith, 1821), *Elephas maximus indicus* (Cuvier, 1798), and *Bos gaurus* (C. H. Smith, 1827).

BWS has a subtropical, monsoon-type climate, with an average annual temperature of 22.5 °C and relative humidity ranging from 42% in February, to 96% in July. The average yearly rainfall measures 2,621 mm (Climate-Data.org 2023). BWS is categorised within the North-East-Brahmaputra Valley (9A) province of the Northeast India biogeographic zone (MoeF 2009).

Our study area can be categorised into forest, degraded forest, riparian, and forest edge habitats. The forest is the primary habitat type and covers almost half (45.61%) of the area of BWS (Sarma and Sarma 2008). The forest type is classified as Eastern Himalayan Moist Deciduous Forest (Champion and Seth 1968). A significant portion of BWS is covered by degraded forest, primarily in the western and southwestern parts. Surrounding much of the degraded forest are settlements and tea plantations. Riparian habitat lines BWS's eastern and western boundaries adjacent to the rivers. These riparian habitats host small grassy patches, mainly consisting of Kans grass *Saccharum spontaneum* L. and cogon grass *Imperata cylindrica* (L.) Raeusch. Additionally, BWS encompasses a limited expanse of scrubland and grassland. In our study, we combined scrubland areas with the degraded forest category, while grassland areas were classified with the riparian habitat group due to their proximity and similar characteristics.

METHODS

Bird surveys were carried out between March 2019 and V.2022, in all four seasons: winter, pre-monsoon, monsoon, and retreating monsoon. Sampling throughout these seasons ensured that migratory bird species were also included. During the nationwide COVID-19 lockdown, field visits were severely limited from May to August 2020 and April to July 2021. For the bird survey, 24 sampling stations were established, covering all four habitat types within our study area (Table 1). These sampling points were randomly selected from six grids per habitat, with a grid size of 500 meters on the map. We conducted point transect surveys with a fixed radius of 30 m (Bibby et al. 2000). Birds were observed in the morning (0630 hours) and evening (1600 hours). Unfavourable weather conditions such as fog, rain, and high winds were avoided due to their known impact on bird activity and detection (Bibby et al. 2000). All birds seen or heard within a 30 m radius were identified and recorded. Each count lasted for 15 minutes. Birds were observed using Olympus 8×40 binoculars, and photographs were taken of most observed species. No specimens were collected during our study.

For species identification, Birds of the Indian Subcontinent (Grimmett et al. 2011) was used in the field. The Book of Indian Birds by Ali (1979) and other resources, such as Birds of the World (2022), were consulted to confirm certain species. The nomenclature and taxonomy were followed as per the eBird/Clements checklist of Birds of the World (Clements et al. 2022). Birds were categorised as resident (R), local migrant (LM), summer visitor (SV), or winter visitor (WV) based on our field observation and description from Grimmett et al. (2011). The conservation and national protection status of species were determined following the IUCN Red List of Threatened Species (2022) and the Wildlife Protection Act of 1972, respectively.

Diversity was measured for each habitat type using the Shannon Diversity Index (Shannon and Weaver 1963). Shannon Diversity Index (H') assumes that all species are evenly distributed in a sample and that the sample is randomly obtained. Shannon Diversity Index: $H' = -\sum_{i=1}^s p_i \ln p_i$

Here, p_i is the proportion of individuals found of the i^{th} species, \ln is the natural logarithm, and s represents the number of species.

Table 1. Geographical location of sampling stations in BWS.

| Sites | Latitude | Longitude | Elevation a.s.l. (m) | Habitat |
|-------|----------|-----------|----------------------|----------|
| S1 | 26.8108 | 091.7230 | 243 | Forest |
| S2 | 26.8076 | 091.7218 | 204 | Forest |
| S3 | 26.8066 | 091.7288 | 196 | Forest |
| S4 | 26.8102 | 091.7351 | 210 | Forest |
| S5 | 26.8005 | 091.7230 | 192 | Forest |
| S6 | 26.7958 | 091.7452 | 186 | Forest |
| S7 | 26.8100 | 091.7508 | 204 | Forest |
| S8 | 26.7832 | 091.7528 | 178 | Forest |
| S9 | 26.8098 | 091.7713 | 201 | Edge |
| S10 | 26.7810 | 091.7556 | 176 | Edge |
| S11 | 26.7801 | 091.7422 | 171 | Edge |
| S12 | 26.7831 | 091.7281 | 172 | Edge |
| S13 | 26.7741 | 091.7109 | 147 | Edge |
| S14 | 26.7785 | 091.7104 | 152 | Edge |
| S15 | 26.7847 | 091.7106 | 153 | Degraded |
| S16 | 26.7900 | 091.7114 | 157 | Degraded |
| S17 | 26.8015 | 091.7163 | 186 | Degraded |
| S18 | 26.8058 | 091.7121 | 191 | Degraded |
| S19 | 26.8137 | 091.7548 | 210 | Degraded |
| S20 | 26.8093 | 091.7089 | 192 | Riparian |
| S21 | 26.8063 | 091.7046 | 170 | Riparian |
| S22 | 26.8033 | 091.7064 | 173 | Riparian |
| S23 | 26.8017 | 091.7328 | 173 | Riparian |
| S24 | 26.8299 | 091.7621 | 237 | Riparian |

RESULTS

During the survey period, 2,582 individuals from 227 avian species across 65 families and 18 orders were documented (Table 2). Passerines made up 53.6% (120 species) of the total number of species. The Accipitridae family had the highest diversity among non-Passeriformes with 15 species, while the Muscicapidae family was the most diverse family within the Passeriformes with 17 species. Of the 227 species recorded, 72.3% were resident, while 27.7% were migratory. Among the migratory species, 52 were winter visitors, 9 were summer visitors, and certain species, like *Dendrocygna javanica* (Horsfield, 1821), were classified as local migratory (Table 3).

We observed highest species richness in the Forest habitat (117 species), followed by Edge (112 species), Degraded Forest (94 species), and Riparian habitat (81 species) (Table 2; Figure 3). In all, 43 species were exclusive to Riparian habitat, while Forest had 37, Edge had 27, and Degraded Forest had 19. Additionally, 20 species were present across all habitat types. Among specific abundances, *Pycnonotus cafer* (Linnaeus, 1766) was most abundant in degraded habitat, *Acridotheres tristis* (Linnaeus, 1766) in riparian habitat, and *Treron phoenicopterus* (Latham, 1790) in forest and edge habitats. The Shannon diversity index was highest for the Edge habitat ($H' = 3.95$) and lowest for the Riparian habitat ($H' = 3.34$). The rarefaction curve for our

Table 2. Summary of species richness, abundance and diversity in BWS.

| Habitat type | Species richness | No. of Individuals | Shannon Diversity Index (H') |
|-----------------|------------------|--------------------|------------------------------|
| Edge | 112 (27) | 755 | 3.95 |
| Degraded forest | 94 (19) | 510 | 3.89 |
| Forest | 117 (37) | 765 | 3.94 |
| Riparian | 81 (43) | 552 | 3.34 |

*Numbers within parenthesis signify unique species observed only in the particular habitat

Table 3. Annotated list of birds from Bornadi Wildlife Sanctuary. Legend: IUCN: International Union for Conservation of Nature, LC: Least Concern, NT: Near Threatened, VU: Vulnerable, EN: Endangered, WPA: Indian Wildlife Protection Act, 1972, SC-I: Schedule List I species, SC-IV: Schedule List IV species, SC-V: Schedule List V species, MS: Migratory Status, R: Resident, LM: Local Migrant, SV: Summer Visitor, WV: Winter Visitor, De: Degraded habitat, Ed: Edge habitat, Fo: Forest habitat, Ri: Riparian Habitat, RA: Relative Abundance.

| Order, family, species | Common Name | IUCN status | WPA status | MS | Habitat (RA%) | | | |
|-----------------------------------|-----------------------------|-------------|------------|----|---------------|-------|-------|------|
| | | | | | De | Ed | Fo | Ri |
| Anseriformes | | | | | | | | |
| Anatidae | | | | | | | | |
| <i>Dendrocygna javanica</i> | Lesser Whistling Duck | LC | Sc-IV | LM | — | — | — | 0.91 |
| Galliformes | | | | | | | | |
| Phasianidae | | | | | | | | |
| <i>Gallus gallus</i> | Red Junglefowl | LC | Sc-IV | R | 0.20 | 0.26 | 0.39 | — |
| <i>Lophura leucomelanos</i> | Kalij Pheasant | LC | Sc-I | R | — | — | 0.13 | — |
| <i>Pavo cristatus</i> | Indian Peafowl | LC | Sc-I | R | 4.71 | 1.72 | 3.01 | 0.18 |
| Columbiformes | | | | | | | | |
| Columbidae | | | | | | | | |
| <i>Treron phoenicoptera</i> | Yellow-footed Green Pigeon | LC | Sc-IV | R | 5.10 | 14.04 | 16.08 | 0.54 |
| <i>Treron apicauda</i> | Wedge-tailed Green Pigeon | LC | Sc-IV | R | 0.59 | — | 0.39 | — |
| <i>Treron curvirostra</i> | Thick-billed Green Pigeon | LC | Sc-IV | R | — | 1.59 | — | 1.27 |
| <i>Treron phayrei</i> | Ashy-headed Green Pigeon | NT | Sc-IV | R | — | — | 0.26 | — |
| <i>Treron apicauda</i> | Pin-tailed Green Pigeon | LC | Sc-IV | R | — | — | 0.26 | — |
| <i>Ducula badia</i> | Mountain Imperial Pigeon | LC | Sc-IV | R | — | 0.26 | — | — |
| <i>Ducula aenea</i> | Green Imperial Pigeon | NT | Sc-IV | R | — | — | 0.26 | — |
| <i>Columba livia</i> | Rock Pigeon | LC | | R | 0.39 | 0.40 | — | — |
| <i>Streptopelia orientalis</i> | Oriental Turtle-Dove | LC | Sc-IV | R | 0.39 | 0.66 | 0.39 | — |
| <i>Streptopelia decaocto</i> | Eurasian Collared-Dove | LC | Sc-IV | R | — | — | 0.65 | — |
| <i>Streptopelia chinensis</i> | Spotted Dove | LC | Sc-IV | R | 0.78 | 3.18 | — | 1.27 |
| <i>Streptopelia tranquebarica</i> | Red Collared-Dove | LC | Sc-IV | R | 0.20 | — | — | 1.27 |
| <i>Chalcophaps indica</i> | Asian Emerald Dove | LC | Sc-IV | R | 0.39 | 0.53 | 0.39 | — |
| Cuculiformes | | | | | | | | |
| Cuculidae | | | | | | | | |
| <i>Centropus bengalensis</i> | Lesser Coucal | LC | | R | 0.20 | — | — | — |
| <i>Centropus sinensis</i> | Greater Coucal | LC | | R | — | 0.13 | — | — |
| <i>Hierococcyx varius</i> | Common Hawk-Cuckoo | LC | Sc-IV | LM | 0.39 | 0.53 | — | — |
| <i>Phaenicophaeus tristis</i> | Green-billed Malkoha | LC | Sc-IV | R | — | 0.26 | 0.78 | — |
| <i>Eudynamys scolopaceus</i> | Asian Koel | LC | Sc-IV | R | 0.20 | 0.13 | — | — |
| <i>Cacomantis merulinus</i> | Plaintive Cuckoo | LC | Sc-IV | R | 0.20 | — | 0.13 | — |
| <i>Cacomantis sonneratii</i> | Banded Bay Cuckoo | LC | Sc-IV | R | 0.20 | — | — | — |
| <i>Cuculus micropterus</i> | Indian Cuckoo | LC | Sc-IV | SV | — | — | — | 0.18 |
| <i>Surniculus lugubris</i> | Square-tailed Drongo-cuckoo | LC | Sc-IV | SV | — | 0.13 | — | — |
| Caprimulgiformes | | | | | | | | |
| Caprimulgidae | | | | | | | | |
| <i>Caprimulgus affinis</i> | Savanna Nightjar | LC | Sc-IV | R | 0.20 | — | — | — |
| <i>Caprimulgus climacurus</i> | Large-tailed Nightjar | LC | Sc-IV | R | — | — | 0.13 | — |
| Apodidae | | | | | | | | |
| <i>Collocalia brevirostris</i> | Himalayan Swiftlet | LC | | R | — | — | 0.39 | — |
| <i>Apus nipalensis</i> | House Swift | LC | | R | — | — | — | 0.72 |
| <i>Cypsiurus balasiensis</i> | Asian Palm-swift | LC | | R | 1.18 | — | 1.05 | 7.79 |
| Gruiformes | | | | | | | | |
| Rallidae | | | | | | | | |
| <i>Amaurornis phoenicurus</i> | White-breasted Waterhen | LC | | R | — | — | — | 0.18 |
| Charadriiformes | | | | | | | | |
| Burhinidae | | | | | | | | |
| <i>Burhinus indicus</i> | Indian Thick-knee | LC | | R | — | — | — | 0.18 |
| Ibidorhynchidae | | | | | | | | |
| <i>Ibidorhyncha struthersii</i> | Ibisbill | LC | | WV | — | — | — | 0.18 |

| Order, family, species | Common Name | IUCN status | WPA status | MS | Habitat (RA%) | | | |
|--------------------------------|---------------------------|-------------|------------|----|---------------|------|------|------|
| | | | | | De | Ed | Fo | Ri |
| Charadriidae | | | | | | | | |
| <i>Vanellus indicus</i> | Red-wattled Lapwing | LC | | R | 1.37 | — | — | 1.27 |
| <i>Vanellus duvaucelii</i> | River Lapwing | NT | | R | — | — | — | 0.72 |
| Scolopacidae | | | | | | | | |
| <i>Tringa nebularia</i> | Common Greenshank | LC | Sc-IV | WV | — | — | — | 0.18 |
| <i>Tringa glareola</i> | Wood Sandpiper | LC | Sc-IV | WV | — | — | — | 0.18 |
| <i>Actitis hypoleucos</i> | Common Sandpiper | LC | Sc-IV | WV | — | — | — | 0.18 |
| Ciconiiformes | | | | | | | | |
| Ciconiidae | | | | | | | | |
| <i>Ciconia nigra</i> | Black Stork | LC | Sc-IV | WV | — | — | — | 0.18 |
| <i>Anastomus oscitans</i> | Asian Openbill Stork | LC | Sc-IV | R | — | — | — | 0.36 |
| Suliformes | | | | | | | | |
| Phalacrocoracidae | | | | | | | | |
| <i>Microcarbo niger</i> | Little Cormorant | LC | Sc-IV | R | 0.39 | — | — | 1.45 |
| <i>Phalacrocorax carbo</i> | Great Cormorant | LC | Sc-IV | WV | — | — | — | 0.36 |
| Pelecaniformes | | | | | | | | |
| Ardeidae | | | | | | | | |
| <i>Ardea purpurea</i> | Purple Heron | LC | Sc-IV | R | — | — | — | 0.18 |
| <i>Ardeola grayii</i> | Indian Pond Heron | LC | Sc-IV | R | — | — | — | 0.18 |
| <i>Bubulcus ibis</i> | Cattle Egret | LC | Sc-IV | R | 0.20 | 0.26 | — | 2.36 |
| <i>Ardea intermedia</i> | Intermediate Egret | LC | Sc-IV | R | — | — | — | 0.18 |
| <i>Egretta garzetta</i> | Little Egret | LC | Sc-IV | R | — | — | — | 1.09 |
| <i>Nycticorax nycticorax</i> | Black-crowned Night-heron | LC | Sc-IV | R | — | — | — | 0.18 |
| <i>Ixobrychus cinnamomeus</i> | Striated Heron | LC | Sc-IV | R | — | — | — | 0.18 |
| <i>Ixobrychus cinnamomeus</i> | Cinnamon Bittern | LC | Sc-IV | R | — | — | — | 0.18 |
| Accipitriformes | | | | | | | | |
| Accipitridae | | | | | | | | |
| <i>Gyps himalayensis</i> | Himalayan Griffon | NT | Sc-IV | WV | 0.39 | — | — | — |
| <i>Elanus caeruleus</i> | Black-winged Kite | LC | | R | — | 0.13 | — | — |
| <i>Milvus migrans</i> | Black Kite | LC | | R | — | 0.13 | — | — |
| <i>Accipiter nisus</i> | Eurasian Sparrowhawk | LC | | R | — | — | — | 0.36 |
| <i>Accipiter trivirgatus</i> | Crested Goshawk | LC | | R | — | — | 0.13 | — |
| <i>Accipiter badius</i> | Shikra | LC | | R | 0.20 | — | 0.13 | — |
| <i>Accipiter virgatus</i> | Besra | LC | | R | — | — | 0.13 | — |
| <i>Pernis ptilorhynchus</i> | Oriental Honey-buzzard | LC | | R | — | 0.26 | — | 0.36 |
| <i>Spilornis cheela</i> | Crested Serpent-eagle | LC | | R | 0.98 | 0.13 | 0.78 | 0.36 |
| <i>Nisaetus cirrhatus</i> | Changeable Hawk-eagle | LC | | R | 0.20 | — | — | — |
| <i>Ictinaetus malaiensis</i> | Black Eagle | LC | | R | — | — | 0.26 | — |
| <i>Hieraaetus pennatus</i> | Booted Eagle | LC | | WV | 0.20 | — | — | — |
| <i>Clanga clanga</i> | Greater Spotted Eagle | VU | | WV | — | — | 0.13 | — |
| <i>Lophotriorchis kienerii</i> | Rufous Bellied Eagle | NT | | R | 0.20 | — | — | — |
| <i>Aquila nipalensis</i> | Steppe Eagle | EN | | WV | — | — | — | 0.18 |
| Strigiiformes | | | | | | | | |
| Tytonidae | | | | | | | | |
| <i>Tyto alba</i> | Barn Owl | LC | | R | — | 0.13 | — | — |
| Strigidae | | | | | | | | |
| <i>Athene brama</i> | Spotted Owlet | LC | Sc-IV | R | — | 0.13 | — | — |
| <i>Otus sunia</i> | Oriental Scops Owl | LC | Sc-IV | R | — | 0.13 | — | — |
| <i>Glaucidium cuculoides</i> | Asian Barred Owlet | LC | Sc-IV | R | — | 0.13 | — | — |
| <i>Ninox scutulata</i> | Brown Hawk-owl | LC | Sc-IV | R | — | 0.13 | — | — |
| <i>Otus lettia</i> | Collared Scops-owl | LC | Sc-IV | R | — | — | 0.13 | — |
| <i>Ketupa nipalensis</i> | Spot-bellied Eagle Owl | LC | Sc-IV | R | — | 0.13 | — | — |
| Bucerotiformes | | | | | | | | |
| Upupidae | | | | | | | | |
| <i>Upupa epops</i> | Eurasian Hoopoe | LC | | R | 0.20 | — | — | — |

| Order, family, species | Common Name | IUCN status | WPA status | MS | Habitat (RA%) | | | |
|--------------------------------------|------------------------------|-------------|------------|-------|---------------|------|------|------|
| | | | | | De | Ed | Fo | Ri |
| Bucerotidae | | | | | | | | |
| <i>Buceros bicornis</i> | Great Hornbill | VU | Sc-I | R | — | 0.26 | 0.13 | — |
| <i>Rhyticeros undulatus</i> | Wreathed Hornbill | VU | Sc-I | R | 1.18 | — | — | — |
| <i>Anthracoceros albirostris</i> | Oriental Pied Hornbill | LC | | R | — | 0.13 | 0.65 | — |
| Coraciiformes | | | | | | | | |
| Alcedinidae | | | | | | | | |
| <i>Halcyon smyrnensis</i> | White-throated Kingfisher | LC | Sc-IV | R | 1.18 | 0.13 | 0.13 | — |
| <i>Alcedo atthis</i> | Common Kingfisher | LC | Sc-IV | R | — | — | — | 0.72 |
| <i>Megaceryle lugubris</i> | Crested Kingfisher | LC | Sc-IV | R | — | — | — | 0.18 |
| Meropidae | | | | | | | | |
| <i>Merops philippinus</i> | Blue-tailed Bee-eater | LC | | SV | — | — | — | 0.91 |
| <i>Merops leschenaulti</i> | Chestnut-headed Bee-eater | LC | | SV | 2.55 | — | 1.44 | — |
| <i>Merops orientalis</i> | Green Bee-eater | LC | | SV/LM | — | 0.79 | 0.52 | 2.17 |
| <i>Nyctyornis athertoni</i> | Blue Bearded Bee-eater | LC | | R | — | 0.26 | 0.39 | — |
| Coraciidae | | | | | | | | |
| <i>Coracias affinis</i> | Indochinese Roller | LC | Sc-IV | R | 0.20 | 0.26 | — | 0.18 |
| <i>Eurystomus orientalis</i> | Dollarbird | LC | | R | — | — | 0.13 | — |
| Piciformes | | | | | | | | |
| Megalaimidae | | | | | | | | |
| <i>Psilopogon haemacephalus</i> | Coppersmith Barbet | LC | Sc-IV | R | 0.59 | 0.66 | 0.26 | — |
| <i>Psilopogon asiaticus</i> | Blue-throated Barbet | LC | Sc-IV | R | 1.76 | 2.78 | 2.88 | — |
| <i>Psilopogon lineata</i> | Lineated Barbet | LC | Sc-IV | R | 1.18 | 2.38 | 1.05 | — |
| <i>Psilopogon duvaucelii</i> | Blue-eared Barbet | LC | Sc-IV | R | 0.20 | — | — | — |
| <i>Psilopogon virens</i> | Great Barbet | LC | Sc-IV | R | — | 0.26 | 0.78 | — |
| Picidae | | | | | | | | |
| <i>Picumnus innominatus</i> | Speckled Piculet | LC | Sc-IV | R | — | — | 0.13 | — |
| <i>Yungipicus canicapillus</i> | Grey-capped Pigmy Woodpecker | LC | Sc-IV | R | — | 0.93 | 0.13 | — |
| <i>Dendrocopos macei</i> | Fulvous-breasted Woodpecker | LC | Sc-IV | R | 0.39 | 1.46 | 0.26 | — |
| <i>Micropternus brachyurus</i> | Rufous Woodpecker | LC | Sc-IV | R | 0.20 | 0.13 | 0.13 | — |
| <i>Chrysocolaptes guttacristatus</i> | Greater Flameback | LC | Sc-IV | R | — | 0.26 | — | — |
| <i>Dinopium benghalense</i> | Black-rumped Flameback | LC | Sc-IV | R | — | 0.40 | 0.13 | — |
| <i>Picus chlorolophus</i> | Lesser Yellownape | LC | Sc-IV | R | 0.20 | 0.26 | 0.26 | — |
| <i>Chrysophlegma flavinucha</i> | Greater Yellownape | LC | Sc-IV | R | — | — | 0.26 | — |
| <i>Picus canus</i> | Grey-headed Woodpecker | LC | Sc-IV | R | — | 0.53 | — | — |
| Falconiformes | | | | | | | | |
| Falconidae | | | | | | | | |
| <i>Falco tinnunculus</i> | Common Kestrel | LC | Sc-IV | WV | — | 0.66 | 0.13 | — |
| <i>Falco subbuteo</i> | Eurasian Hobby | LC | | WV | 0.20 | — | — | — |
| <i>Microhierax melanoleucos</i> | Pied Falconet | LC | Sc-IV | R | — | 0.13 | — | — |
| <i>Falco peregrinus</i> | Peregrine Falcon | LC | Sc-I | WV/LM | — | — | — | 0.18 |
| Psittaciformes | | | | | | | | |
| Psittaculidae | | | | | | | | |
| <i>Psittacula alexandri</i> | Red-breasted Parakeet | NT | Sc-IV | R | 0.39 | — | 0.26 | — |
| <i>Psittacula krameri</i> | Rose-ringed Parakeet | LC | Sc-IV | R | — | 0.40 | — | — |
| Passeriformes | | | | | | | | |
| Pittidae | | | | | | | | |
| <i>Pitta sordida</i> | Hooded Pitta | LC | Sc-IV | SV | — | 0.26 | 0.26 | — |
| Campephagidae | | | | | | | | |
| <i>Coracina macei</i> | Large Cuckooshrike | LC | | R | 0.78 | 0.26 | 3.14 | — |
| <i>Lalage melaschistos</i> | Black-winged Cuckooshrike | LC | | WV | 0.20 | — | — | — |
| <i>Pericrocotus speciosus</i> | Scarlet Minivet | LC | Sc-IV | R | 1.37 | 0.66 | 0.92 | — |
| <i>Pericrocotus ethologus</i> | Long-tailed Minivet | LC | Sc-IV | WV | — | 0.79 | 0.26 | — |
| <i>Pericrocotus brevirostris</i> | Short-billed Minivet | LC | Sc-IV | R | — | 0.53 | 0.26 | — |
| <i>Pericrocotus cinnamomeus</i> | Small Minivet | LC | Sc-IV | R | 0.59 | — | — | — |

| Order, family, species | Common Name | IUCN status | WPA status | MS | Habitat (RA%) | | | |
|-----------------------------------|-------------------------------|-------------|------------|----|---------------|------|------|-------|
| | | | | | De | Ed | Fo | Ri |
| Oriolidae | | | | | | | | |
| <i>Oriolus xanthornus</i> | Black-hooded Oriole | LC | Sc-IV | R | 0.20 | 1.19 | 0.39 | — |
| <i>Oriolus traillii</i> | Maroon Oriole | LC | Sc-IV | R | — | — | 0.52 | — |
| Artamidae | | | | | | | | |
| <i>Artamus fuscus</i> | Ashy Woodswallow | LC | | R | 0.39 | — | 0.39 | 0.54 |
| Vangidae | | | | | | | | |
| <i>Tephrodornis pondicerianus</i> | Common Woodshrike | LC | | R | — | — | 1.57 | — |
| <i>Tephrodornis virgatus</i> | Large Woodshrike | LC | | R | — | — | 0.26 | — |
| Aegithinidae | | | | | | | | |
| <i>Aegahina tiphia</i> | Common Iora | LC | | R | 0.98 | 0.13 | 1.44 | — |
| Rhipiduridae | | | | | | | | |
| <i>Rhipidura albicollis</i> | White-throated Fantail | LC | | R | — | 0.13 | 0.13 | — |
| Dicruridae | | | | | | | | |
| <i>Dicrurus macrocercus</i> | Black Drongo | LC | Sc-IV | R | 0.98 | 0.53 | 0.39 | 0.72 |
| <i>Dicrurus hottentottus</i> | Hair-crested Drongo | LC | Sc-IV | R | 2.16 | 1.72 | 3.14 | — |
| <i>Dicrurus aeneus</i> | Bronzed Drongo | LC | Sc-IV | R | — | 0.26 | 0.65 | — |
| <i>Dicrurus remifer</i> | Lesser Racket-tailed Drongo | LC | Sc-IV | R | — | 0.13 | 0.13 | — |
| <i>Dicrurus paradiseus</i> | Greater Racket-tailed Drongo | LC | Sc-IV | R | 0.20 | — | 0.52 | — |
| <i>Dicrurus leucophaeus</i> | Ashy Drongo | LC | Sc-IV | WV | 0.20 | 0.40 | 0.39 | 0.18 |
| Monarchidae | | | | | | | | |
| <i>Hypothymis azurea</i> | Black-naped Monarch | LC | | R | 0.39 | 0.53 | — | — |
| Laniidae | | | | | | | | |
| <i>Lanius cristatus</i> | Brown Shrike | LC | | WV | 0.39 | 0.26 | 0.13 | — |
| <i>Lanius schach</i> | Long-tailed Shrike | LC | | WV | 0.20 | 0.40 | — | 0.54 |
| <i>Lanius tephronotus</i> | Grey-backed Shrike | LC | | WV | 0.39 | 0.26 | 0.26 | 0.18 |
| Corvidae | | | | | | | | |
| <i>Dendrocitta formosae</i> | Grey Treepie | LC | Sc-IV | R | — | 0.13 | — | — |
| <i>Dendrocitta vagabunda</i> | Rufous Treepie | LC | Sc-IV | R | 0.98 | 1.06 | 0.13 | 0.36 |
| <i>Cissa chinensis</i> | Common Green Magpie | LC | Sc-IV | R | — | — | 0.13 | — |
| <i>Corvus splendens</i> | House Crow | LC | Sc-V | R | — | 0.13 | — | — |
| <i>Corvus macrorhynchos</i> | Large-billed Crow | LC | | R | 0.20 | 0.40 | — | 0.72 |
| Stenostiridae | | | | | | | | |
| <i>Culicicapa ceylonensis</i> | Grey-headed Canary Flycatcher | LC | Sc-IV | WV | 0.78 | 2.25 | 1.44 | 0.18 |
| Paridae | | | | | | | | |
| <i>Parus cinereus</i> | Cinereous Tit | LC | Sc-IV | R | — | 0.26 | 0.26 | — |
| <i>Cephalopyrus flammiceps</i> | Fire-capped Tit | LC | Sc-IV | WV | — | — | 0.13 | — |
| Alaudinidae | | | | | | | | |
| <i>Alauda gulgula</i> | Oriental Skylark | LC | | WV | 0.39 | — | — | 0.36 |
| Cisticolidae | | | | | | | | |
| <i>Cisticola juncidis</i> | Zitting Cisticola | LC | | R | 0.20 | — | — | — |
| <i>Orthotomus sutorius</i> | Common Tailorbird | LC | | R | 0.98 | 0.79 | 2.09 | 0.72 |
| <i>Prinia inornata</i> | Plain Prinia | LC | | R | — | — | — | 0.36 |
| Acrocephalidae | | | | | | | | |
| <i>Acrocephalus agricola</i> | Paddyfield Warbler | LC | | WV | 0.20 | — | — | — |
| <i>Acrocephalus dumetorum</i> | Blyth's Reed Warbler | LC | | WV | — | — | — | 0.18 |
| Hirundinidae | | | | | | | | |
| <i>Hirundo rustica</i> | Barn Swallow | LC | | WV | — | — | — | 0.18 |
| <i>Riparia chinensis</i> | Grey-throated Martin | LC | | R | — | — | — | 0.18 |
| <i>Delichon nipalense</i> | Nepal House-Martin | LC | | R | — | — | — | 0.18 |
| Pycnonotidae | | | | | | | | |
| <i>Pycnonotus cafer</i> | Red-vented Bulbul | LC | Sc-IV | R | 12.55 | 9.54 | 9.67 | 17.39 |
| <i>Pycnonotus jocosus</i> | Red-whiskered Bulbul | LC | Sc-IV | R | 6.47 | 0.93 | 2.48 | 2.72 |
| <i>Pycnonotus flaviventris</i> | Black-crested Bulbul | LC | Sc-IV | R | 3.53 | 3.18 | 3.79 | 1.45 |
| <i>Hypsipetes leucocephalus</i> | Black Bulbul | LC | Sc-IV | R | 4.51 | 3.71 | 5.10 | — |
| <i>Alophoixus flaveolus</i> | White-throated Bulbul | LC | Sc-IV | R | 0.20 | — | 0.65 | — |

| Order, family, species | Common Name | IUCN status | WPA status | MS | Habitat (RA%) | | | |
|----------------------------------|----------------------------------|-------------|------------|----|---------------|------|------|-------|
| | | | | | De | Ed | Fo | Ri |
| Phylloscopidae | | | | | | | | |
| <i>Phylloscopus trochiloides</i> | Greenish Warbler | LC | | WV | 0.78 | 0.13 | 0.78 | — |
| <i>Phylloscopus inornatus</i> | Yellow-browed Warbler | LC | | WV | 0.20 | — | 0.52 | — |
| <i>Phylloscopus affinis</i> | Tickell's Leaf Warbler | LC | | WV | 1.76 | 2.65 | 0.92 | — |
| <i>Phylloscopus reguloides</i> | Blyth's Leaf Warbler | LC | | WV | — | 0.53 | 0.92 | — |
| <i>Phylloscopus burkii</i> | Green-crowned Warbler | LC | | WV | — | 0.13 | 0.26 | — |
| <i>Phylloscopus fuscatus</i> | Dusky Warbler | LC | | WV | 1.96 | 1.06 | 0.52 | 0.18 |
| <i>Phylloscopus humei</i> | Hume's Warbler | LC | | WV | — | — | 0.26 | — |
| <i>Phylloscopus cantator</i> | Yellow-vented Warbler | LC | | WV | — | 0.26 | 0.13 | — |
| Scotocercidae | | | | | | | | |
| <i>Phyllergates cucullatus</i> | Mountain Tailorbird | LC | | R | — | — | 0.13 | — |
| <i>Abroscopus superciliaris</i> | Yellow-bellied Warbler | LC | | R | — | — | 1.05 | — |
| Zosteropidae | | | | | | | | |
| <i>Zosterops palpebrosus</i> | Indian White-eye | LC | Sc-IV | R | 4.31 | 4.90 | 0.92 | — |
| Timaliidae | | | | | | | | |
| <i>Turdoides striata</i> | Jungle Babbler | LC | Sc-IV | R | — | 1.99 | 0.39 | — |
| <i>Mixornis gularis</i> | Pin-striped Tit-Babbler | LC | Sc-IV | R | 0.98 | 0.40 | 0.39 | — |
| Pellorneidae | | | | | | | | |
| <i>Malacocincla abbotti</i> | Abbott's Babbler | LC | | R | — | — | 0.13 | — |
| <i>Pellorneum ruficeps</i> | Puff-throated Babbler | LC | | R | — | — | 0.13 | — |
| Locustellidae | | | | | | | | |
| <i>Megalurus palustris</i> | Striated Grassbird | LC | | R | — | 0.26 | — | — |
| Leiothrichidae | | | | | | | | |
| <i>Alcippe nipalensis</i> | Nepal Fulvetta | LC | | R | — | — | 0.26 | — |
| <i>Pterorhinus ruficollis</i> | Rufous-necked Laughingthrush | LC | | R | 1.18 | 0.66 | — | — |
| <i>Pterorhinus pectoralis</i> | Greater Necklaced Laughingthrush | LC | | R | — | — | 1.31 | — |
| <i>Garrulax monileger</i> | Lesser Necklaced Laughingthrush | LC | | R | — | — | 0.65 | — |
| <i>Minla ignotincta</i> | Red-tailed Minla | LC | | R | — | — | 0.13 | — |
| Tichodromidae | | | | | | | | |
| <i>Tichodroma muraria</i> | Wallcreeper | LC | | WV | — | — | — | 0.18 |
| Sittidae | | | | | | | | |
| <i>Sitta cinnamoventris</i> | Chestnut-bellied Nuthatch | LC | | R | — | 0.13 | — | — |
| <i>Sitta frontalis</i> | Velvet-fronted Nuthatch | LC | | R | — | — | 0.13 | — |
| Sturnidae | | | | | | | | |
| <i>Gracupica contra</i> | Asian Pied Starling | LC | Sc-IV | R | — | 1.99 | — | 5.07 |
| <i>Saroglossa spilopterus</i> | Spot-winged Starling | LC | Sc-IV | WV | — | — | 0.52 | — |
| <i>Sturnia malabarica</i> | Chestnut-tailed Starling | LC | Sc-IV | R | 1.37 | 1.85 | 1.31 | 1.27 |
| <i>Acridotheres tristis</i> | Common Myna | LC | Sc-IV | R | 6.67 | 2.91 | 0.13 | 18.66 |
| <i>Acridotheres fuscus</i> | Jungle Myna | LC | Sc-IV | R | 2.55 | 0.66 | 0.65 | 2.72 |
| <i>Acridotheres grandis</i> | Great Myna | LC | Sc-IV | R | — | 0.13 | — | — |
| <i>Gracula religiosa</i> | Common Hill Myna | LC | Sc-I | R | 0.59 | 0.66 | 0.78 | — |
| Turdinae | | | | | | | | |
| <i>Myophonus caeruleus</i> | Blue Whistling Thrush | LC | Sc-IV | WV | — | 0.26 | — | — |
| <i>Turdus boulboul</i> | Grey-winged Blackbird | LC | | R | — | — | 0.13 | — |
| <i>Geokichla citrina</i> | Orange-headed Thrush | LC | Sc-IV | SV | — | — | 0.26 | — |
| Muscicapidae | | | | | | | | |
| <i>Ficedula albicilla</i> | Taiga Flycatcher | LC | Sc-IV | WV | 0.39 | 1.32 | 1.05 | 0.18 |
| <i>Ficedula strophciata</i> | Rufous-gorgeted Flycatcher | LC | Sc-IV | R | — | 0.13 | 0.13 | — |
| <i>Ficedula westermanni</i> | Little Pied Flycatcher | LC | Sc-IV | R | 0.20 | 0.26 | — | — |
| <i>Cyornis unicolor</i> | Pale Blue Flycatcher | LC | Sc-IV | SV | 0.98 | 0.13 | — | — |
| <i>Eumyias thalassinus</i> | Verditer Flycatcher | LC | Sc-IV | SV | — | — | 0.26 | — |
| <i>Niltava macgrigoriae</i> | Small Niltava | LC | | WV | 0.39 | — | — | — |
| <i>Copsychus saularis</i> | Oriental Magpie-robin | LC | | R | 0.78 | 1.59 | 0.52 | 5.43 |
| <i>Copsychus malabaricus</i> | White-rumped Shama | LC | | R | 0.20 | 0.53 | 0.39 | — |

| Order, family, species | Common Name | IUCN status | WPA status | MS | Habitat (RA%) | | | |
|----------------------------------|-----------------------------|-------------|------------|-------|---------------|------|------|------|
| | | | | | De | Ed | Fo | Ri |
| <i>Saxicola maurus</i> | Siberian Stonechat | LC | | WV | — | — | — | 0.36 |
| <i>Saxicola ferreus</i> | Grey Bushchat | LC | | R | — | — | — | 0.72 |
| <i>Calliope calliope</i> | Siberian Rubythroat | LC | | WV | — | — | 0.26 | — |
| <i>Monticola solitarius</i> | Blue Rock Thrush | LC | | WV | — | — | — | 0.18 |
| <i>Enicurus immaculatus</i> | Black-backed Forktail | LC | | R | — | — | — | 0.18 |
| <i>Phoenicurus fuliginosus</i> | Plumbeous Redstart | LC | | WV/LM | — | — | — | 0.72 |
| <i>Phoenicurus leucocephalus</i> | White-capped Redstart | LC | | WV/LM | — | — | — | 1.99 |
| <i>Phoenicurus hodgsoni</i> | Hodgson's Redstart | LC | | WV | — | — | — | 0.36 |
| <i>Phoenicurus ochruros</i> | Black Redstart | LC | | WV | 0.78 | — | — | 0.36 |
| Dicaeidae | | | | | | | | |
| <i>Dicaeum cruentatum</i> | Scarlet-backed Flowerpecker | LC | Sc-IV | R | — | 0.13 | 0.13 | — |
| <i>Dicaeum minullum</i> | Plain Flowerpecker | LC | Sc-IV | R | 0.20 | 0.26 | 0.65 | 0.54 |
| Nectariniidae | | | | | | | | |
| <i>Aethopyga siparaja</i> | Crimson Sunbird | LC | Sc-IV | R | 0.20 | 0.26 | 0.92 | 0.36 |
| <i>Chalcoparia singalensis</i> | Ruby-cheeked Sunbird | LC | Sc-IV | R | — | 0.13 | — | — |
| <i>Cinnyris asiaticus</i> | Purple Sunbird | LC | Sc-IV | R | — | 0.26 | 0.26 | 0.18 |
| <i>Arachnothera magna</i> | Streaked Spiderhunter | LC | | R | 0.20 | 1.19 | 1.83 | — |
| Irenidae | | | | | | | | |
| <i>Irena puella</i> | Asian Fairy Bluebird | LC | Sc-IV | R | — | — | 0.26 | — |
| Chloropseidae | | | | | | | | |
| <i>Chloropsis moluccensis</i> | Blue-winged Leafbird | LC | | R | — | — | 0.26 | — |
| <i>Chloropsis aurifrons</i> | Golden-fronted Leafbird | LC | | R | 0.20 | 0.40 | 1.18 | — |
| <i>Chloropsis hardwickii</i> | Orange-bellied Leafbird | LC | | R | 0.39 | 0.13 | 0.52 | — |
| Ploceidae | | | | | | | | |
| <i>Ploceus philippinus</i> | Baya Weaver | LC | Sc-IV | R | 0.78 | 0.79 | — | — |
| Estrildidae | | | | | | | | |
| <i>Lonchura punctulata</i> | Scaly-breasted Munia | LC | Sc-IV | R | 0.39 | — | — | — |
| <i>Lonchura striata</i> | White-rumped Munia | LC | Sc-IV | R | 0.39 | — | — | — |
| <i>Lonchura atricapilla</i> | Chestnut Munia | LC | Sc-IV | R | — | 0.26 | — | — |
| Passeridae | | | | | | | | |
| <i>Passer domesticus</i> | House Sparrow | LC | | R | — | 0.26 | — | — |
| <i>Passer montanus</i> | Eurasian Tree Sparrow | LC | | R | — | 0.26 | — | — |
| Motacillidae | | | | | | | | |
| <i>Motacilla alba</i> | White Wagtail | LC | | WV | 0.59 | — | 0.13 | 2.36 |
| <i>Motacilla cinerea</i> | Grey Wagtail | LC | | WV | — | — | — | 0.36 |
| <i>Motacilla maderaspatensis</i> | White-browed Wagtail | LC | | WV/LM | — | — | — | 0.36 |
| <i>Anthus richardi</i> | Richard's Pipit | LC | Sc-IV | WV | — | — | — | 0.18 |
| <i>Anthus rufulus</i> | Paddyfield Pipit | LC | Sc-IV | R | — | — | — | 0.18 |
| <i>Anthus hodgsoni</i> | Olive-backed Pipit | LC | Sc-IV | WV | — | 0.26 | — | — |
| <i>Anthus roseatus</i> | Rosy Pipit | LC | Sc-IV | WV | 0.39 | — | — | — |
| Fringillidae | | | | | | | | |
| <i>Carpodacus erythrinus</i> | Common Rosefinch | LC | Sc-IV | WV | — | 0.26 | — | — |

sampling effort across the entire study area did not reach a plateau at its peak, suggesting the possibility of finding a few more species with additional survey effort (Figure 2). The rank abundance plot indicated that a few species were highly abundant compared to others in each habitat type (Figure 4).

Regarding the IUCN Red List status, of the observed species, one species (*Aquila nipalensis* Hodgson, 1833) was Endangered, three species were Vulnerable, and six species belonged to the Near Threatened category (Table 3). Additionally, six species are listed as Schedule I species under the Wildlife Protection Act of 1972, ensuring high protection.

The observation notes of some species recorded from BWS are described below.

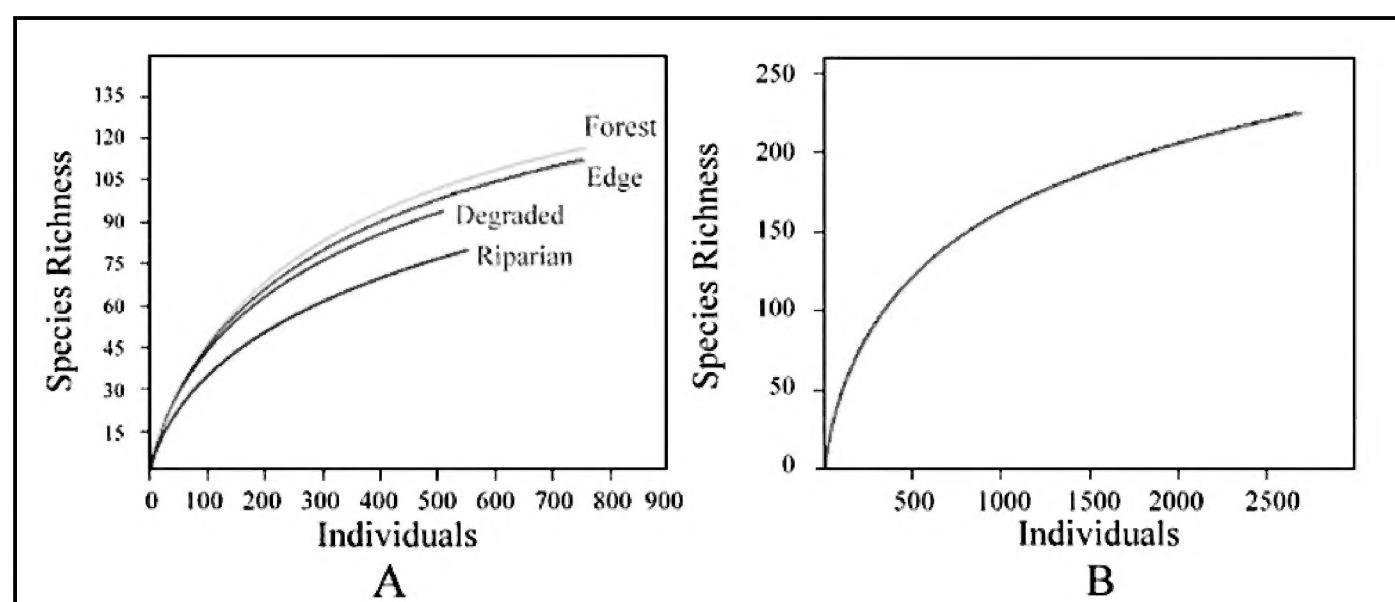


Figure 2. Species rarefaction curve for the survey sampling effort. **A.** Among different habitat types **B.** Entire study area of BWS.

Figure 3. Overlap of bird species across different habitats in BWS, shown with a Venn diagram depicting the number of species observed.

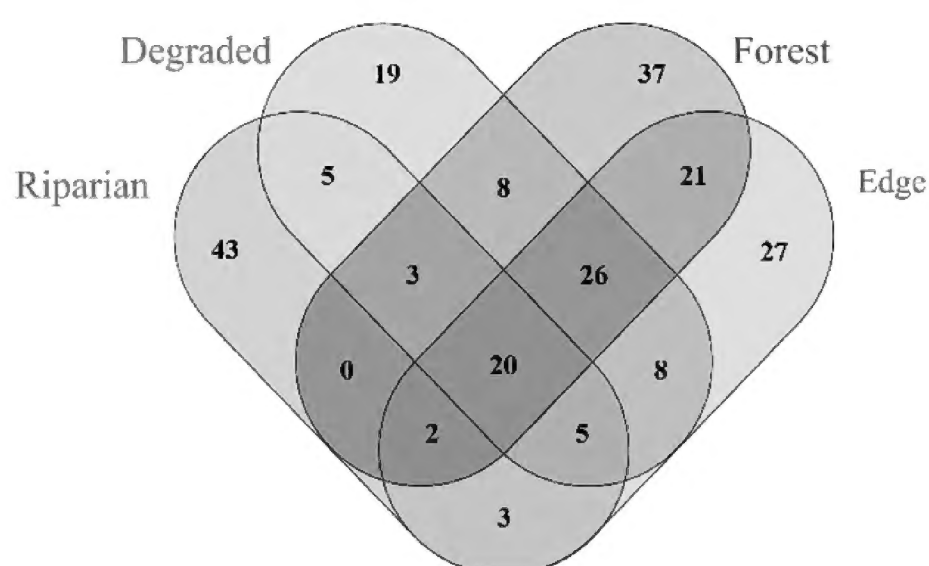
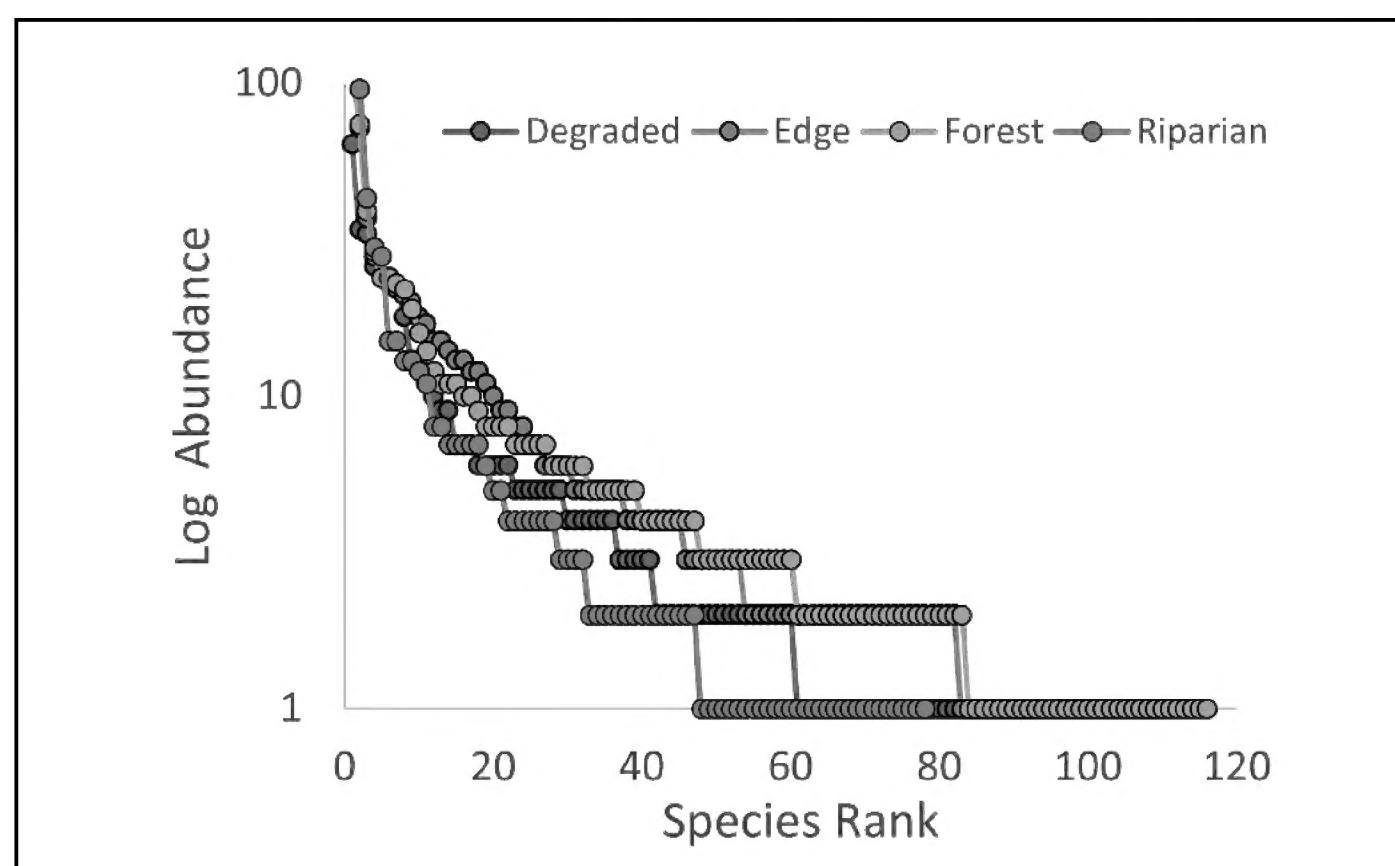


Figure 4. Distribution of bird species abundance across the various habitat types of BWS.



Family Phasianidae

***Gallus gallus* (Linnaeus, 1758)**

Red Junglefowl

Figure 5A

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S6; 26.7958, 091.7452; 186 m a.s.l.; 25.II.2021, 01.XI.2021, 09.III.2022; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S11; 26.7801, 091.7422; 171 m a.s.l.; 21.XI.2019; V. Chetry obs.; forest edge • Udalguri, Bornadi Wildlife Sanctuary; S19; 26.8137, 091.7548; 210 m a.s.l.; 24.III.2019; V. Chetry & P. Mahananda obs.; degraded forest.

Identification. Males identified by orange hackles, blackish underpart and long, sickle-like tail. Females have rufous-coloured heads and lack blackish underparts.

***Pavo cristatus* (Linnaeus, 1758)**

Indian Peafowl

Figure 5B

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; 26.7900, 091.711419; 158 m a.s.l.; 6.IX.2019; V. Chetry & P. Mahananda obs.; forest edge.

Identification. Males with prominent, long green tail feathers with ocellus patterns. Females lack long tail feathers, and upper bodies are mostly brown.

Family Columbidae

***Treron sphenurus* (Vigors, 1832)**

Wedge-tailed Green-Pigeon

Figure 5C

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S5; 26.8005, 091.7230 192 m a.s.l. 10 March 2022; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S18; 26.8058, 091.7121; 191 m a.s.l.; 25.II.2021; V. Chetry obs.; degraded forest.

Identification. Head and underparts bright greenish. Pale orange colouration at the crown in males, which females lack. Males also exhibit a distinctive wedge-shaped tail with maroon underparts.

Family Caprimulgidae

***Caprimulgus climacurus* Horsfield, 1821**

Large-tailed Nightjar

Figure 5D

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S7; 26.8100, 091.7508; 204 m a.s.l.; 27.I.2021; V. Chetry obs.; forest.

Identification. Tail large, with prominent buff on the outer feathers, upper parts are brown in colour. In males, white spots present on the four outermost primaries, whereas females exhibit buff spots.

Family Charadriidae

***Vanellus duvaucelii* (Lesson, 1826)**

River Lapwing

Figure 5E

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S23; 26.8017, 091.7328; 173 m a.s.l. 24.II.2020; V. Chetry obs.; riparian • Udalguri, Bornadi Wildlife Sanctuary; S24; 26.8299, 091.7621; 237 m a.s.l.; 25.II.2021; V. Chetry obs.; riparian.

Identification. Face, throat and crest are black, bill and legs are also black.

Family Ciconiidae

***Ciconia nigra* (Linnaeus, 1758)**

Black Stork

Figure 5F

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S23; 26.801715, 091.732786; 173 m a.s.l.; 25.II.2021; V. Chetry obs.; riparian.

Identification. Stork with glossy black body and white belly. Legs and bill red.

Family Phalacrocoracidae

***Phalacrocorax carbo* (Linnaeus, 1758)**

Great Cormorant

Figure 5G

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S20; 26.809259, 091.708909; 192 m a.s.l.; 28.I.2020; V. Chetry obs.; riparian.

Identification. Glossy black body with yellow gular skin and distinct white cheeks. Larger than little cormorant.



Figure 5. Birds of BWS **A.** *Gallus gallus* **B.** *Pavo cristatus* **C.** *Treron apicauda* **D.** *Caprimulgus climacurus* **E.** *Vanellus duvaucelii* **F.** *Ciconia nigra* **G.** *Phalacrocorax carbo* **H.** *Ardeola grayii* **I.** *Bubulcus ibis* **J.** *Gyps himalayensis* **K.** *Milvus migrans* **L.** *Accipiter nisus*.

Family Ardeidae

***Ardeola grayii* (Sykes, 1832)**

Indian Pond Heron

Figure 5H

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S22; 26.8033, 091.7064; 173 m a.s.l.; 10.III.2022; 25.II.2021; V. Chetry obs.; riparian.

Identification: Brown body with streaked pattern, white wings, bill yellow with black tip.

***Bubulcus ibis* (Linnaeus, 1758)**

Cattle Egret

Figure 5I

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S21; 26.8063, 091.7046; 170 m a.s.l.; 24.II.2020, 06.VII.2020; V. Chetry obs.; riparian • Udalguri, Bornadi Wildlife Sanctuary; S24; 26.8299, 091.7621; 237m a.s.l.; 07.IX.2019 25.II.2021; V. Chetry obs.; riparian • Udalguri, Bornadi Wildlife Sanctuary; S20; 26.8093, 091.7089; 192 m a.s.l.; 31.X.2021; V. Chetry obs.; edge.

Identification. White-coloured, short-necked, stocky bird with a yellow bill. Breeding plumage has orange-buff on the head.

Family Accipitridae

***Gyps himalayensis* Hume, 1869**

Himalayan Griffon

Figure 5J

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S19; 26.8137, 091.7548; 210 m a.s.l.; 24.II.2020; V. Chetry obs.; degraded forest.

Identification. Large vulture with whitish wing-coverts and body, contrasts with dark flight feathers and tail.

***Milvus migrans* (Boddaert, 1783)**

Black Kite

Figure 5K

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S14; 26.7785, 091.7104; 152 m a.s.l.; 29.I.2020; V. Chetry obs.; edge.

Identification. Reddish-brown kite with distinct forked tail. Juveniles heavily streaked with contrasting brown and whitish colour.

***Accipiter nisus* (Linnaeus, 1758)**

Eurasian Sparrowhawk

Figure 5L

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S24; 26.8299, 091.7621; 237 m a.s.l.; 25.II.2021; V. Chetry obs.; riparian.

Identification. Average-sized accipiter with distinct barring on underparts, including both wings and tail. Male has a slaty-grey upperpart and orange barring underparts, female with dark brown upperparts and underpart barring.

***Accipiter virgatus* (Temminck, 1822)**

Besra

Figure 6A

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 30.XII.2019; V. Chetry & P. Mahananda obs.; edge.

Identification. Small in size, features a small bill and head. Upperparts dark, displaying a slaty-black colour, underparts heavily barred.

***Pernis ptilorhynchus* (Temminck, 1821)**

Oriental Honey-buzzard

Figure 6B

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S21; 26.8063, 091.7046; 170 m a.s.l.; 06.IX.2019, 07.XI.2019 V. Chetry obs.; riparian • Udalguri, Bornadi Wildlife Sanctuary; S11; 26.7801, 091.7422; 171 m a.s.l.; 31.X.2021; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S12; 26.7831, 091.7281; 172 m a.s.l.; 21.XI.2022; V. Chetry obs.; edge.

Identification. Head and bill small, face grey-coloured, tail marked with two black bands. Polymorphic, many variations in plumage colouration.

***Hieraaetus pennatus* (Gmelin, 1788)**

Booted Eagle

Figure 6C

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S14; 26.7785, 091.7104; 152 m a.s.l.; 25.II.2021; V. Chetry obs.; degraded forest.

Identification. Resembling a kite with long and narrow wings. Pale morph has whitish underparts, dark morph resembles a black kite in appearance. White patches on shoulders a distinct feature of all morphs.

***Lophotriorchis kienerii* (de Sparre, 1835)**

Rufous-bellied Eagle

Figure 6D

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 23.II.2020; V. Chetry obs.; edge.

Identification. Small eagle with dark blackish hood and upperparts, throat and breast white, accompanied by rufous-coloured underparts.

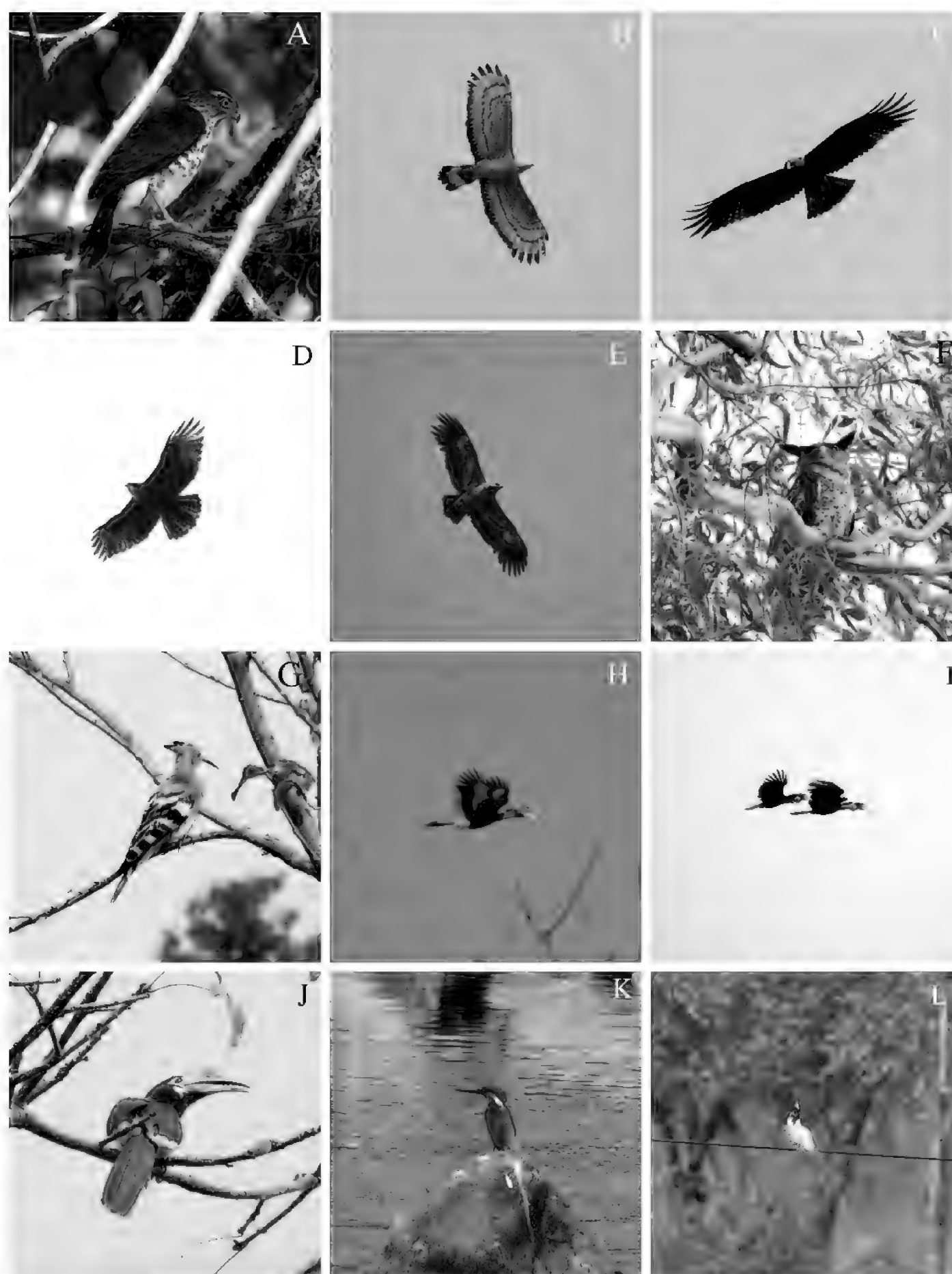


Figure 6. Birds of BWS **A.** *Accipiter virgatus* **B.** *Spilornis cheela* **C.** *Hieraetus pennatus* **D.** *Lophotriorchis kienerii* **E.** *Clanga clanga* **F.** *Ketupa nipalensis* **G.** *Upupa epops* **H.** *Buceros bicornis* **I.** *Rhyticeros undulatus* **J.** *Anthracoseros albirostris* **K.** *Alcedo atthis* **L.** *Megaceryle lugubris*.

***Aquila nipalensis* Hodgson, 1833**

Steppe Eagle

Figure 6E

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S12; 26.7831, 091.7281; 172 m a.s.l.; 21.II.2020; V. Chetry obs.; edge.

Identification. Large-sized eagle with dark brown colour, primaries banded, iris brown. Pale rufous patch on the nape, light-coloured chin.

Family Strigidae

***Ketupa nipalensis* (Hodgson, 1836)**

Spot-bellied Eagle Owl

Figure 6F

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 10.III.2022; V. Chetry obs.; edge.

Identification. Large owl with dark brown upperparts and whitish buff underparts. Prominent ear tufts slant outward, tarsus fully feathered.

Family Upupidae

***Upupa epops* Linnaeus, 1758**

Eurasian Hoopoe

Figure 6G

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S15; 26.7847, 091.7106; 153 m a.s.l.; 26.II.2021; V. Chetry obs.; degraded forest.

Identification. Rufous-coloured bird with distinct black and white wings and tail. Downward curved long bill, crest with black tip resembling a fan when erect.

Family Bucerotidae

***Buceros bicornis* Linnaeus, 1758**

Great Hornbill

Figure 6H

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S11; 26.7801, 091.7422; 171 m a.s.l.; 11.III.2022; V. Chetry obs.; edge.

Identification. Large-sized hornbill with yellow bill, casque and neck. Body predominantly black, with a white tail bearing a black band. Male eyes have red iris, females have white.

***Rhyticeros undulatus* (Shaw, 1811)**

Wreathed Hornbill

Figure 6I

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S18; 26.8058, 091.7121; 191 m a.s.l.; 26.II.2021; V. Chetry obs.; degraded forest.

Identification. Large hornbill with black body, white tail, and whitish neck. Male distinguished by yellow gular pouch with black bar, female features a black neck and blue gular pouch.

***Anthracoceros albirostris* (Shaw, 1808)**

Oriental Pied-hornbill

Figure 6J

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 21.II.2020; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832, 091.7528; 178 m a.s.l.; 22.II.2020, 27.I.2021, 26.II.2021; V. Chetry obs.; forest.

Identification. Hornbill with distinctive black and white colouring, with yellow bill and casque. Tail long and black, with white tips. Circumorbital skin blue.

Family Alcedinidae

***Alcedo atthis* (Linnaeus, 1758)**

Common Kingfisher

Figure 6K

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S20; 26.8093, 091.7089; 192 m a.s.l.; 06.IX.2019, 28.I.2020, 24.II.2020; V. Chetry obs.; Hill stream.

Identification. Small blue-coloured kingfisher with barred blue-black crown and rufous ear coverts. Females similar except for a reddish lower mandible.

***Megaceryle lugubris* (Temminck, 1834)**

Crested Kingfisher

Figure 6L

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S21; 26.8063, 091.7046; 170 m a.s.l.; 24.II.2020; V. Chetry obs.; Riverbank.

Identification. Large black and white coloured kingfisher with a prominent crest. Males with rufous patch on the breast, females have a rufous underwing patch.

Family Meropidae

***Merops leschenaultia* Vieillot, 1817**

Chestnut-headed Bee-eater

Figure 7A

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S6; 26.7958, 091.7452; 186 m a.s.l.; 24.III.2019, 21.II.2020; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S2; 26.8076, 091.7218; 204 m a.s.l.; 17.XII.2020, 09.IX.2021; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S18; 26.8058, 091.7121; 191 m a.s.l.; 24.II.2021, 26.II.2021; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S15; 26.7847, 091.7106; 153 m a.s.l.; 10.III.2022; V. Chetry obs.; degraded forest.

Identification. Green-coloured bird with long tail and downcurved bill. Crown, nape and mantle chestnut coloured, throat yellow. Sexes similar.

Family Coraciidae

***Eurystomus orientalis* (Linnaeus, 1766)**

Dollarbird

Figure 7B

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S3; 26.8066, 091.7288; 196 m a.s.l.; 10.V.2022; V. Chetry obs.; forest.

Identification. Dark greenish-blue coloured bird. Bill and eye ring red. Sexes similar.

Family Megalaimidae

***Psilopogon asiaticus* (Latham, 1790)**

Blue-throated Barbet

Figure 7C

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S17; 26.8015, 091.7163; 186 m a.s.l.; 16.XII.2020, 09.IX.2021; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S18; 26.8058, 091.7121; 191 m a.s.l.; 10.III.2021; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S9; 26.8098, 091.7713; 201 m a.s.l.; 22.II.2020, 24.II.2020; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 02.XII.2019; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S11; 26.7801, 091.7422; 171 m a.s.l.; 31.X.2021, 11.II.2022; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S13; 26.7741, 091.7109; 147 m a.s.l.; 12.V.2022; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S6; 26.7958, 091.7452; 186 m a.s.l.; 21.XI.2019, 30.XI.2019, 10.V.2022, 11.V.2022; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832, 091.7528; 178 m a.s.l.; 29.I.2020, 21.II.2020, 17.XII.2020, 18.XII.2020, 25.II.2021, 01.XI.2021, 09.III.2021; V. Chetry obs.; forest.

Identification. Green-coloured bird with red forehead. Throat, upper breast, and auricular blue. Sexes similar.

***Psilopogon virens* (Boddaert, 1783)**

Great Barbet

Figure 7D

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832, 091.7528; 178 m a.s.l.; 21.II.2020, 09.IX.2021; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S1; 26.8108, 091.7230; 243 m a.s.l.; 09.III.2022; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S12; 26.7831, 091.7281; 172 m a.s.l.; 11.III.2022; V. Chetry obs.; edge.

Identification. Largest barbet with a large yellow bill and dark bluish head. Wings, rump and tail green.

Family Picidae

***Picumnus innominatus* Burton, 1836**

Speckled Piculet

Figure 7E

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S5; 26.8005, 091.7230; 192 m a.s.l.; 29.I.2020; V. Chetry obs.; forest.

Identification. Small bird with brown-greenish upper part and a very short black coloured tail. Dark eye stripe flanked by white-bordered stripes. Males have orange foreheads, females have uniform olive colouration on forehead and crown.



Figure 7. Birds of BWS **A.** *Merops leschenaultia* **B.** *Eurystomus orientalis* **C.** *Psilopogon asiaticus* **D.** *Psilopogon virens* **E.** *Picumnus innominatus* **F.** *Micropternus brachyurus* **G.** *Chrysocolaptes guttacristatus* **H.** *Picus canus* **I.** *Falco tinnunculus* **J.** *Microhierax melanoleucos* **K.** *Psittacula kramera* **L.** *Tephrodornis pondicerianus*.

***Micropternus brachyurus* (Vieillot, 1818)**

Rufous Woodpecker

Figure 7F

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S19; 26.8137, 091.7548; 210 m a.s.l.; 24.III.2019; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S2; 26.8076, 091.7218; 204 m a.s.l.; 27.I.2021, V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S9; 26.8098, 091.7713; 201 m a.s.l.; 23.II.2020; V. Chetry obs.; edge.

Identification. Reddish-brown in colour with black bill. Black barred on entire body except for head and breast. Ear coverts red in males, buff infemales.

***Chrysocolaptes guttacristatus* (Tickell, 1833)**

Greater Flameback

Figure 7G

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 23.II.2020, 25.II.2020; V. Chetry obs.; edge.

Identification. Golden colouration on mantle and upper back. Black and white scale-like pattern on breast and underpart. Males have red foreheads and crests, females have black and white spotted foreheads and crests.

***Picus canus* Gmelin, 1788**

Grey-headed Woodpecker

Figure 7H

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 24.II.2020, 24.II.2021; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S9; 26.8098, 091.7713; 201 m a.s.l.; 11.III.2022, 12.V.2022; V. Chetry obs.; edge.

Identification. Male has a red forehead and forecrown; black in females. Upper body olive-green, under-body a grey-greenish uniform colour.

Family Falconidae

***Falco tinnunculus* Linnaeus, 1758**

Common Kestrel

Figure 7I

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S14; 26.7785, 091.7104; 152 m a.s.l.; 01.XI.2021; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832 091.7528; 178 m a.s.l.; 24 Mar 2019; V. Chetry obs.; forest.

Identification. Males with grey head and tail, upperwing reddish with black spots, underparts pale coloured, spotted. Females lack grey colouration, tail barring distinct from males.

***Microhierax melanoleucos* (Blyth, 1843)**

Pied Falconet

Figure 7J

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S14; 26.7785, 091.7104; 152 m a.s.l.; 15 Mar 2020; V. Chetry obs.; edge.

Identification. Small-sized falconet with black eye stripe, black upperparts and white underparts.

Family Psittacidae

***Psittacula krameri* (Scopoli, 1769)**

Rose-ringed Parakeet

Figure 7K

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 08.III.2022; V. Chetry obs.; edge.

Identification. Green-coloured bird with long tail and red-coloured upper bill. Male has a pink line on the nape, joining a black chin stripe. Female lacks a pink line and chin stripe.

Family Vangidae

***Tephrodornis pondicerianus* (“Gmelin, JF”, 1789)**

Common Woodshrike

Figure 7L

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832, 091.7528; 178 m a.s.l.; 29.I.2020; V. Chetry obs.; forest.

Identification. Brown-coloured bird with dark eye stripe, brown iris, and white supercilium.

***Tephrodornis virgatus* (Temminck, 1824)**

Large Woodshrike

Figure 8A

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832, 091.7528; 178 m a.s.l.; 30.XII.2019; V. Chetry obs.; forest.

Identification. Throat, lower back and rump white, tail greyish-brown. Male has a black mask, female has a pale brown mask.



Figure 8. Birds of BWS **A.** *Tephrodornis virgatus* **B.** *Aegithina tiphia* **C.** *Dicrurus leucophaeus* **D.** *Dendrocitta vagabunda* **E.** *Culicicapa ceylonensis* **F.** *Pycnonotus jocosus* **G.** *Pycnonotus flaviventris* **H.** *Hypsipetes leucocephalus* **I.** *Phylloscopus trochiloides* **J.** *Phylloscopus reguloides* **K.** *Tichodroma muraria* **L.** *Saroglossa spilopterus*.

Family Aegithinidae

***Aegithina tiphia* (Linnaeus, 1758)**

Common Iora

Figure 8B

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S11; 26.7801, 091.7422; 171 m a.s.l.; 02.XII.2019; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S7; 26.8100, 091.7508; 204 m a.s.l.; 29.I.2020, 17.XII.2020, 01.XI.2021; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S5; 26.8005, 091.7230; 192 m a.s.l.; 09.III.2020, 10.V.2022, V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S16; 26.7900, 091.7114; 157 m a.s.l.; 16.XII.2020; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S18; 26.8058, 091.7121; 191 m a.s.l.; 10.III.2022; V. Chetry obs.; degraded forest.

Identification. Yellowish-green males with black tail, females with green tail.

Family Dicruridae

***Dicrurus leucophaeus* Vieillot, 1817**

Ashy Drongo

Figure 8C

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S15; 26.7847, 091.7106; 153 m a.s.l.; 23.III.2019; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S21; 26.8063, 091.7046; 170 m a.s.l.; 07.XI.2019; V. Chetry obs.; riparian • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 02.XII.2019; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832, 091.7528; 178 m a.s.l.; 01.XI.2020; V. Chetry obs.; forest.

Identification. Drongo with slaty-grey upperparts and underparts. Iris distinctly bright red.

Family Corvidae

***Dendrocitta vagabunda* (Latham, 1790)**

Rufous Treepie

Figure 8D

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S5; 26.8005, 091.7230; 192 m a.s.l.; 24.III.2019; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S22; 26.8033, 091.7064; 173 m a.s.l.; 07.IX.2019, 06.VII.2020; V. Chetry obs.; riparian • Udalguri, Bornadi Wildlife Sanctuary; S19; 26.8137, 091.7548; 210 m a.s.l.; 01.XII.2019, 10.III.2022; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 21.XI.2019, 21.II.2020, 24.II.2020; V. Chetry obs.; edge.

Identification. Large treepie with long, black-tipped tail. Head and throat sooty-black, upper parts rufous, underparts pale and buff. Sexes are alike.

Family Stenostiridae

***Culicicapa ceylonensis* (Swainson, 1820)**

Grey-headed Canary-flycatcher

Figure 8E

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832, 091.7528; 178 m a.s.l.; 30.XII.2019, 29.I.2020; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S24; 26.8299, 091.7621; 237 m a.s.l.; 28.I.2020 • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 21.II.2020, 18.XII.2020, 21.XI.2022; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S15; 6.784733, 091.7106; 153 m a.s.l.; 31.X.2020, 01.XI.2020; V. Chetry obs.; degraded forest.

Identification. Medium-sized flycatcher with an upright stance. Head and breast grey, underparts yellow and upperpart primarily green. Bill black.

Family Pycnonotidae

***Pycnonotus jocosus* (Linnaeus, 1758)**

Red-whiskered Bulbul

Figure 8F

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S22; 26.8033, 091.7064; 173 m a.s.l.; 07.IX.2019, 24.II.2020; V. Chetry obs.; riparian • Udalguri, Bornadi Wildlife Sanctuary; S7; 26.8100, 091.7508; 204 m a.s.l.; 30.XI.2019, 18.XII.2020, 10.V.2022; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S16 26.7900, 091.7114; 157 m a.s.l.; 22.II.2020, 10.III.2022; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S14; 26.7785, 091.7104; 152 m a.s.l.; 31.X.2021; V. Chetry obs.; edge.

Identification. Medium-sized bulbul with brown upperpart and whitish underpart. Black crest, red patch behind eye, and white lower ear coverts with distinct moustache strips present.

***Rubigula flaviventris* (Tickell, 1833)**

Black-crested Bulbul

Figure 8G

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S22; 26.8033, 091.7064; 173 m a.s.l.; 07.IX.2019; V. Chetry obs.; riparian • Udalguri, Bornadi Wildlife Sanctuary; S7; 26.8100, 091.7508; 204 m a.s.l.; 30.XI.2019, 18.XII.2020, 11.V.2022; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S16 26.7900, 091.7114; 157 m a.s.l.; 22.II.2020, 10.III.2022; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S14; 26.7785, 091.7104; 152 m a.s.l.; 29 Jan 2020; V. Chetry obs.; edge.

Identification. Head, bill and crest black. Upperparts olive green, underparts mostly yellow. Iris yellow. Both sexes are similar.

***Hypsipetes leucocephalus* (Gmelin, 1789)**

Black Bulbul

Figure 8H

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S7; 26.8100, 091.7508; 204 m a.s.l.; 29.I.2020, 21.II.2020; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S16; 26.7900, 091.7114; 157 m a.s.l.; 22.II.2020, 10.III.2022; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S14; 26.7785, 091.7104; 152 m a.s.l.; 22.II.2020; V. Chetry obs.; edge.

Identification. Grey-black bulbul with a small crest. Bill, legs, and feet red.

Family Phylloscopidae

***Phylloscopus trochiloides* (Sundevall, 1837)**

Greenish Warbler

Figure 8I

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S19; 26.8137, 091.7548; 210 m a.s.l.; 16.XII.2020, 30.X.2021; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S2; 26.8076, 091.7218; 204 m a.s.l.; 17.XII.2020, 01.XI.2021; V. Chetry obs.; forest. S9; 26.8098, 091.7713; 201 m a.s.l.; 18.XII.2020. V. Chetry obs.; edge.

Identification. Green-coloured upper body, underparts pale or whitish. Long whitish supercilium that meets over the bill, single white wing bar.

***Phylloscopus reguloides* (Blyth, 1842)**

Blyth's Leaf Warbler

Figure 8J

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S7; 26.8100, 091.7508; 204 m a.s.l.; 21.II.2020; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 24.II.2020; V. Chetry obs.; edge.

Identification. Medium-sized warbler with yellow supercilium and crown stripe. Upperparts olive-green, underparts yellowish.

Family Tichodromidae

***Tichodroma muraria* (Linnaeus, 1766)**

Wallcreeper

Figure 8K

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S20; 26.8093, 091.7089; 192 m a.s.l.; 24.II.2021, 08.III.2022; V. Chetry & P. Mahananda obs.; riparian.

Identification. Grey-coloured bird with long, black, downcurved bill and red wing coverts.

Family Sturnidae

***Saroglossa spilopterus* (Vigors, 1831)**

Spot-winged Starling

Figure 8L

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S6; 26.7958, 091.7452; 186 m a.s.l.; 30.XII.2019, 18.XII.2020; V. Chetry obs.; forest.

Identification. Male has blackish-grey face, reddish-brown throat underparts, pale-brown and greyish upperparts. Female has brown upperparts. White iris and wing patch present in both sexes.

***Gracula religiosa* Linnaeus, 1758**

Common Hill Myna

Figure 9A

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S16; 26.7900, 091.7114; 157 m a.s.l.; 24.III.2019; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 30.XI.2019, 18.XII.2020; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S4; 26.8102, 091.7351; 210 m a.s.l.; 27.I.2021, 09.III.2022, 10.V.2022. V. Chetry obs.; forest.



Figure 9. Birds of BWS **A.** *Gracula religiosa* **B.** *Cyornis unicolor* **C.** *Copsychus saularis* **D.** *Saxicola maurus* **E.** *Monticola solitarius* **F.** *Saxicola ferreus* **G.** *Phoenicurus leucocephalus* **H.** *Chalcoparia singalensis* **I.** *Arachnothera magna* **J.** *Irena puella* **K.** *Chloropsis aurifrons* **L.** *Motacilla alba*.

Identification. Large myna with black body, orange bill, yellow wattles, and a distinct white patch on the wing.

Family Muscicapidae

***Cyornis poliogenys* W.E. Brooks, 1880**

Pale-chinned Blue Flycatcher

Figure 9B

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S17; 26.8015, 091.7163; 186 m a.s.l.; 16.XII.2020; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S12; 26.7831, 091.7281; 172 m a.s.l.; 25.I.2021; V. Chetry obs.; edge.

Identification. Body mostly olive-brown, crown and ear coverts grey, pale orange throat with creamy-orange breast.

***Copsychus saularis* (Linnaeus, 1758)**

Oriental Magpie-robin

Figure 9C

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.;

21.XI.2019, 02.XII.2019, 12.V.2022; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S11; 26.7801, 091.7422; 171 m a.s.l.; 21.II.2020, 25.II.2021; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832091.7528; 178 m a.s.l.; 30.XII.2019, 10.V.2020, 17.XII.2020; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S16; 26.7900, 091.7114; 157 m a.s.l.; 22.II.2020; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S22; 26.8033, 091.7064; 173 m a.s.l.; 06.VII.2020; V. Chetry obs.; riparian.

Identification. Male has black head, upperparts and breasts. Belly white-coloured, white bands present on the wing. Females similar, except black colour replaced by grey.

***Saxicola maurus* (Pallas, 1773)**

Siberian Stonechat

Figure 9D

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S24; 26.8299, 091.7621; 237 m a.s.l.; 29.I.2020; V. Chetry obs.; riparian.

Identification. Male with black head, nape and back. Wwhite patch seen on lateral side of neck; breast orange, belly gradually white from the orange breast region. Female has brown head and upperpart with faint pale brown supercilium.

***Monticola solitarius* (Linnaeus, 1758)**

Blue Rock Thrush

Figure 9E

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S20; 26.8093, 091.7089; 192 m a.s.l.; 28.I.2020; V. Chetry obs.; riparian.

Identification. Males greyish-blue, darker in tail and wing regions. Female with dull brownish-grey upperpart and buff scaling underpart.

***Saxicola ferreus* J.E. Gray & G.R. Gray, 1847**

Grey Bushchat

Figure 9F

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S20; 26.8093, 091.7089; 192 m a.s.l.; 28.I.2020; V. Chetry obs.; riparian.

Identification. Male has greyish-black upperparts with a white supercilium. Underparts mostly whitish, with slightly dark skin at the breast. Bill and legs black. Female lacks a greyish-black upperpart, but with rufous colouration and buff throat and supercilium.

***Phoenicurus leucocephalus* Vigors, 1831**

White-capped Redstart

Figure 9G

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S20; 26.8093, 091.7089; 192 m a.s.l.; 28.I.2020, 24.II.2020, 08.III.2022; V. Chetry obs.; riparian.

• Udalguri, Bornadi Wildlife Sanctuary; S22; 26.8033, 091.7064; 173 m a.s.l.; 07.IX.2019, 07.XI.2019; V. Chetry & P. Mahananda obs.; riparian.

Identification. Bill, head, upper body, and legs black. Adult has a white cap, underparts are orange-chestnut. Sexes are alike.

Family Nectariniidae

***Chalcoparia singalensis* (Gmelin, 1789)**

Ruby-cheeked Sunbird

Figure 9H

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S9; 26.8098, 091.7713; 201 m a.s.l.; 02.XII.2019; V. Chetry obs.; edge.

Identification. Sunbird with a short black bill, red iris, orange throat, and yellow underparts. Male has shiny green upperparts and ruby cheeks; female has olive upperparts and lacks ruby colouration on the cheeks.

***Arachnothera magna* (Hodgson, 1836)**

Streaked Spiderhunter

Figure 9I

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 02.XII.2019, 29.I.2020, 21.II.2020; V. Chetry obs.; edge.

• Udalguri, Bornadi Wildlife Sanctuary; S7; 26.8100, 091.7508; 204 m a.s.l.; 30.XII.2019, 17.XII.2019; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S19 26.8137, 091.7548; 210 m a.s.l.; 09.IX.2021; V. Chetry obs.; degraded forest.

Identification. Small bird with a long, downcurved bill, streaked olive upperparts, and streaked whitish underparts.

Family Irenidae

***Irena puella* (Latham, 1790)**

Asian Fairy Bluebird

Figure 9J

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832, 091.7528; 178 m a.s.l.; 29.I.2020; V. Chetry obs.; forest.

Identification. Male with blue upperparts and black underparts. Females dull blue coloured. Red eye distinct in both sexes.

Family Chloropseidae

***Chloropsis aurifrons* (Temminck, 1829)**

Golden-fronted Leafbird

Figure 9K

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S16; 26.7900, 091.7114; 157 m a.s.l.; 24.III.2019; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S2; 26.8076, 091.7218; 204 m a.s.l.; 21.XI.2019, 25.II.2021; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S9; 26.8098, 091.7713; 201 m a.s.l.; 02.XII.2019, 29.I.2020; V. Chetry obs.; edge.

Identification. Green bird with prominent golden forehead, blue malar, and black throat.

Family Motacillidae

***Motacilla alba* Linnaeus, 1758**

White Wagtail

Figure 9L

Observations. INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S20 26.8093, 091.7089; 192 m a.s.l.; 10.III.2023; V. Chetry obs.; riparian.

Identification. Head has a black-and-white pattern with a white forehead; mantle is black. Legs and bill black. Tail is long, and the upperpart is black.

DISCUSSION

BWS is a contiguous Transboundary Manas Conservation Area (TraMCA) forest spread over 6,500 km² in the eastern Himalayas (Ahmed et al. 2016). Due to its contiguity and diverse habitat types, high avian diversity is known in the study area. The high number of species that were found exclusively in riparian habitat, highlights the importance of habitat heterogeneity in promoting species richness. Such heterogeneity accommodates the specific requirements of various species, offering abundant food sources in forested, waterbody, and farmland areas, leading to enhanced bird richness (Tu et al. 2020). The present study demonstrates that the contiguity of the forested area of the sanctuary directly influences species richness in the forest habitat. Similar trends have been noted by Joshi et al. (2022) for specialist birds. Additionally, studies by Basile et al. (2021) and Asmare et al. (2023) have reported analogous findings, highlighting greater richness in forested habitats. Forest interiors provide enough food year round along with better nesting success. Conversely, open forests and edge habitats render birds more vulnerable due to challenges in finding consistent food sources and increased nest predation (Flaspohler et al. 2001). The BWS is situated in the foothill region of the eastern Himalayas, which might explain the high bird diversity in the sanctuary, particularly of the forest species, which is also evident from other studies (Bell 1984).

The avian species richness recorded here represents 27% of all the bird species known to occur in Assam (Choudhury 2000) and approximately 17% of bird species recorded from India (Grimmett et al. 2011). Despite its small size (26.22 km²), BWS showcases remarkable avian species diversity. This study reveals that nearly 22% of bird species in BWS are winter visitors. Many warbler species found in BWS, including *Phylloscopus trochiloides*, *P. reguloides*, *P. inornatus* and *P. humei*, visit the region during winters, predominantly occupying forested areas and edges, thereby increasing species richness in these habitats.

Other migratory birds include water-dependent species such as *Phoenicurus ochruros*, *Phoenicurus*

hodgsoni, *Motacilla alba*, and *Motacilla cinerea*. These species are commonly found near rivers with boulders and rocky banks. The rivers within BWS provide an ideal habitat for such species, given that they primarily consist of hill streams originating from high-altitude areas within the eastern Himalayan region of Bhutan before entering the sanctuary. Birds from higher altitudes in the Himalayas often migrate to lower elevations during winter. Certain species, such as the Spot-winged Starling (*Saroglossa spilopterus*), undertake longitudinal migrations along the Himalayas, descending to lower elevation areas as part of this process (Grimmett et al. 2011). Sighting of *Ibidorhyncha struthersii*, a winter visitor from high elevation river valleys in the Himalayas, is an interesting find, as it has previously only been reported from Manas National Park (eBird Basic Dataset 2022) and Nameri National Park in Assam (Barua and Sharma 2005).

The overall diversity pattern of BWS is influenced by several factors, including the contiguity of forests and the presence of heterogeneous habitats. The significance of the region is highlighted by the presence of globally threatened and nationally protected species. The absence of detection of *Houbaropsis bengalensis* in BWS during our study raises concerns about the quality of specific habitats. *H. bengalensis* requires grassland habitat, which is presently in degraded condition in the BWS (Collar et al. 2020). Protected areas sharing borders with human settlements and farmlands limit the movement and abundance of forest-dependent avian species while fostering generalist species' diversity and abundance in edge areas. Proper habitat evaluation and management practices are crucial for reviving and sustaining delicate habitats prone to degradation. These efforts will positively impact the avian community and further aid in the conservation of birds in the region.

ACKNOWLEDGEMENTS

We are highly thankful to the Assam Forest Department for granting us permission and support to conduct our research. Our special thanks go to the Range Forest Officer and the dedicated forest guards of Bornadi Wildlife Sanctuary for their invaluable logistical assistance and staffing support. Furthermore, we thank Prof. Jogen Chandra Kalita, Head of the Department of Zoology at Gauhati University, for his valuable support. Additionally, we express our appreciation to the editor and the reviewers for their contributions in enhancing the manuscript.

ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

Funding


This study was self-funded by the authors.


Author contributions


Conceptualization: VC, PKS. Methodology: VC. Investigation: VC. Field data collection: VC, PM. Data Curation: VC. Formal analysis: VC. Writing of original draft: VC, KS, PM. Writing- review and editing: VC, PKS, KS, MKS, PM. Visualization: VC. Supervision: PKS, MKS.


Author ORCID iDs

Vivek Chetry  <https://orcid.org/0000-0002-1899-0028>

Prasanta Kumar Saikia  <https://orcid.org/0000-0003-4220-9411>

Pranjal Mahananda  <https://orcid.org/0000-0003-1430-5908>

Malabika Kakati Saikia  <https://orcid.org/0000-0003-1351-5241>

Kuladip Sarma  <https://orcid.org/0000-0002-8905-1175>

Data availability

All data that support the findings of this study are available in the main text.

REFERENCES

- Ahmed MF, Wangmo S, Lahkar D, Chakraborty P, Sarmah A, Borah J, Wangchuk D, Nidup T, Wangchuk T, Sarma HK, Harihar A, Pickles R (2016) Tigers of Trans-boundary Manas conservation area. Technical Report. 50 pp. https://wwwfasia.awsassets.panda.org/downloads/tigers_of_trasnboundary_manas_area.pdf Accessed on: 2023-3-15.
- Ali S (1979) The book of Indian birds. Bombay Natural History Society, Bombay, India, 187 pp.
- Asmare BD, Derebe Y, Tamer M (2023) Diversity and relative abundance of bird species in the two habitat types of Dokima forest Awi zone, Ethiopia. PLoS ONE 18 (3): e0281595. <https://doi.org/10.1371/journal.pone.0281595>
- Barua M, Sharma P (2005) The birds of Nameri National Park, Assam, India. Forktail 21: 15–26.

- Basile M, Storch I, Mikusiński G** (2021) Abundance, species richness and diversity of forest bird assemblages – the relative importance of habitat structures and landscape context. *Ecological Indicators* 133:108402. <https://doi.org/10.1016/j.ecolind.2021.108402>
- Bell HL** (1984) The importance of foothill forest in the diversity of rainforest birds in New Guinea. *Emu - Austral Ornithology* 84 (4): 225–235. <https://doi.org/10.1071/MU9840225>
- Bibby C, Burgess N, Hill D, Mustoe S** (2000) Bird census techniques. 2nd edition. Academic Press, London, UK, 302 pp.
- BirdLife International** (2023) <https://datazone.birdlife.org/eba/factsheet/129>. Endemic Bird Areas factsheet: Eastern Himalayas. Accessed on: 2023-4-6.
- BirdLife International** (2023) <https://datazone.birdlife.org/site/factsheet/barnadi-wildlife-sanctuary-iba-india>. Important Bird Areas factsheet: Barnadi Wildlife Sanctuary. Accessed on 2023-4-6.
- Birds of the World** (2022) <https://birdsoftheworld.org/bow/home>. Cornell Laboratory of Ornithology, Ithaca, NY, USA. Accessed on: 2023-2-23.
- Chakraborty P, Lalthanpuia, Sharma T, Borah J, Sarmah A** (2015) Faunal diversity in a semi-evergreen forest of Bornadi-Khalingduar complex of Assam, India. *Journal of Threatened Taxa* 7(11): 7770–7775. <https://doi.org/10.11609/jott.o4102.7770-5>
- Champion HG, Seth SK** (1968) A revised survey of forest types of India. Govt. of India Press, New Delhi, India, 404 pp.
- Choudhury A** (2000) The birds of Assam. Gibbon Books and World Wide Fund for Nature-India, North-East Regional Office, Guwahati, India, 240 pp.
- Choudhury A** (2006) Birds of Dibru-Saikhowa national park and biosphere reserve, Assam, India. *Indian Birds* 2 (4): 95–105.
- Clements JF, Schulenberg TS, Iliff MJ, Fredericks TA, Gerbracht JA, Lepage D, Billerman SM, Sullivan BL, Wood CL** (2022) The eBird/Clements checklist of birds of the world: v2022. <https://www.birds.cornell.edu/clementschecklist/download/>. Accessed on: 2023-3-28.
- Climate-Data.org** (2023) <https://en.climate-data.org/search/?q=udalguri>. Accessed on: 2023-4-12.
- Collar N, Garcia EFJ, Sharpe CJ** (2020) Bengal Florican (*Houbaropsis bengalensis*), version 1.0. In *Birds of the world*: del Hoyo J, Elliott A, Sargatal J, Christie DA, de Juana E (Eds) Cornell Lab of Ornithology, Ithaca, NY, USA. <https://doi.org/10.2173/bow.benflo2.01>. Accessed on: 2023-2-16.
- Devi OS, Saikia PK** (2010) A checklist of avian fauna of Gibbon wildlife sanctuary, Jorhat District, Assam. *NeBIO* 1 (3): 1–7.
- eBird Basic Dataset** (2022) <https://ebird.org/data/download/ebd>. Version: EBD_relJan-2022. Cornell Lab of Ornithology, Ithaca, New York, USA. Accessed on: 2022-1-11.
- Flaspohler DJ, Temple SA, Rosenfield RN** (2001) Species-specific edge effects on nest success and breeding bird density in a forested landscape. *Ecological Applications* 11(1): 32–46. [https://doi.org/10.1890/1051-0761\(2001\)011\[0032:sseeon\]2.0.co;2](https://doi.org/10.1890/1051-0761(2001)011[0032:sseeon]2.0.co;2)
- Gregory RD, Strien AV** (2010) Wild bird indicators: using composite population trends of birds as measures of environmental health. *Ornithological Science* 9(1): 3–22. <https://doi.org/10.2326/osj.9.3>
- Grimmett R, Inskipp C, Inskipp T, Allen R** (2011) Birds of the Indian subcontinent. Christopher Helm, New Delhi, India, 528 pp.
- IUCN** (2022) <https://www.iucnredlist.org>. The IUCN red list of threatened species. Version 2022-2. Accessed on: 2023-2-12.
- Jenkins CN, Pimm SL, Joppa LN** (2013) Global patterns of terrestrial vertebrate diversity and conservation. *Proceedings of the National Academy of Sciences* 110(28): E2602–E2610. <https://doi.org/10.1073/pnas.1302251110>
- Joshi A, Baniya S, Shrestha N, Sapkota RP, Baral HS** (2022) Contiguous forest supports higher bird diversity compared to isolated forest: evidence from forest landscape of eastern Nepal. *Global Ecology and Conservation* 36(4): e02133. <https://doi.org/10.1016/j.gecco.2022.e02133>
- Kakati R, Borah D, Saikia PK, Hazarika A** (2022) Birds of Behali wildlife sanctuary – an important bird area of Assam, India 7: 77–107. <https://doi.org/10.24917/25438832.7.6>
- Ministry of Law and Justice** (1972) The wildlife (protection) act of 1972. Government of India Press, New Delhi, India, 82 pp.
- Mahanta N, Islam N, Barman R, Deka S, Borkataki U, Chhetri T, Basumatary S, Rahman M** (2022) A preliminary checklist of avian fauna from Raimona national park of Assam, India. *Applied Ecology and Environmental Sciences* 10(11): 652–664. <https://doi.org/10.12691/aees-10-11-1>
- Mahanta N, Saikia PK, Saikia MK** (2019) Avifaunal assemblages of Jhanjimuk-Kokilamukh IBA complex of Jorhat Assam India - A potential Ramsar site of Assam. *Applied Ecology and Environmental Sciences* 7(3): 101–109.
- Martínez-Núñez C, Martínez-Prentice R, García-Navas V** (2023) Land-use diversity predicts regional bird taxonomic and functional richness worldwide. *Nature Communications* 14(1): 1320. <https://doi.org/10.1038/s41467-023-37027-5>
- MoEF** (2009) India's fourth national report to the convention on biological diversity. New Delhi: Ministry of Environment and Forests, Government of India, 75 pp. http://nbaindia.org/uploaded/Biodiversityindia/4th_report.pdf. Accessed on: 2023-3-28.
- Myers N, Mittermeier RA, Mittermeier CG, da Fonseca GAB, Kent J** (2000) Biodiversity hotspots for conservation priorities. *Nature* 403(6772): 853–858. <https://doi.org/10.1038/35002501>

- Saikia PK, Devi OS** (2011) A checklist of avian fauna at Jeypore reserve forest, eastern Assam, India with special reference to globally threatened and endemic species in the eastern Himalayan biodiversity hotspot. *Journal of Threatened Taxa* 3 (4): 1711–1718. <https://doi.org/10.11609/jott.o2340.1711-8>
- Saikia PK, Saikia MK** (2000) Diversity of bird fauna in northeast India. *Journal of Assam Science Society* 41: 379–396.
- Sarma PK, Sarma K** (2008) Spatial modeling and preparation of decision support system for conservation of biological diversity of Barnadi wildlife sanctuary, Aaranyak, Guwahati, India, 63 pp.
- Shannon CE, Weaver W** (1963) The mathematical theory of communication. University of Illinois Press, Urbana, USA, 125 pp.
- Tu HM, Fan MW, Ko JCJ** (2020) Different habitat types affect bird richness and evenness. *Scientific Reports* 10 (1): 1–11. <https://doi.org/10.1038/s41598-020-58202-4>